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FEBRUARY, 1973

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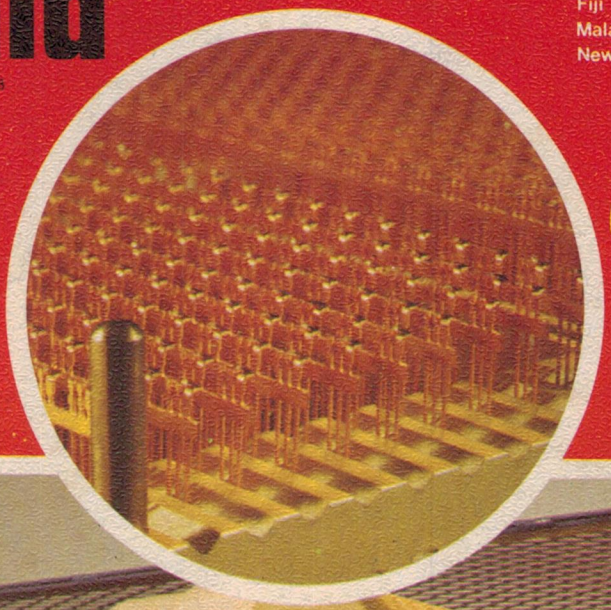

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MOULDING FAIRCHILD'S PLASTIC TRANSISTORS

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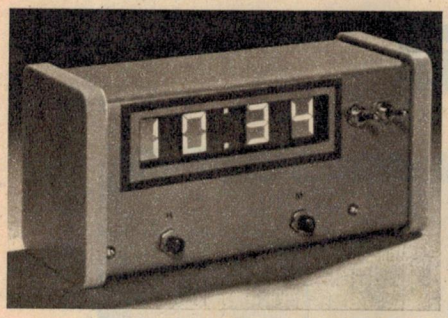

Liquid crystal technology is advancing rapidly, and some experts are predicting that it may ultimately prove as important as semiconductors. Our feature story starting on page 22 explains how liquid crystals work and where they're headed.

If you're a model train buff, you should find this little gadget well worth making. It generates a realistic "chuff-chuff" sound, just like a steam loco. The story starts on page 54.

On the cover

Removing a pair of lead frames from the plastic moulding press at Fairchild Australia's plant in Croydon, Victoria. The circled inset shot shows leadframe devices in carriers ready for moulding. Our feature story describing Fairchild's new TO-92 moulded transistor line starts on page 12.

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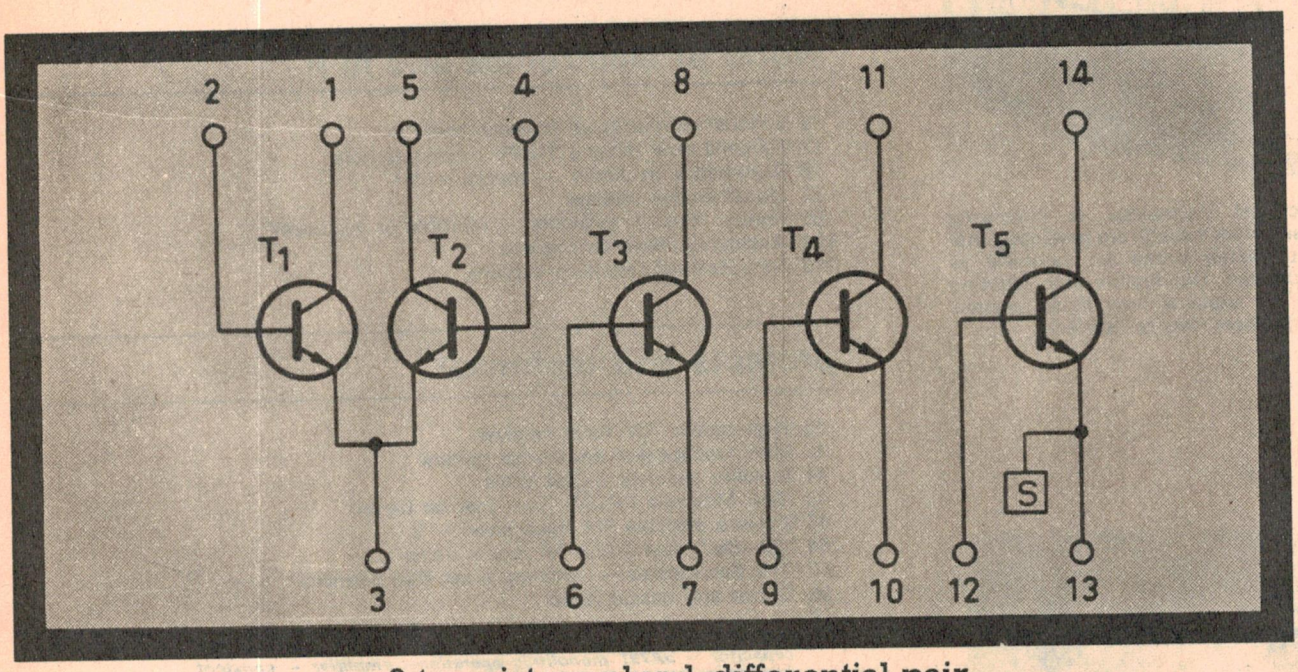
world of electronics and hi-fi

projects and technical

regular features

Need a transistor array?

CA3046B now manufactured in Australia



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EDITORIAL VIEWPOINT

About liquid crystals, and PR

Until about six years ago, liquid crystals and their behaviour were of little more than academic interest. But the sleeper has awakened, and just about all of the major electronics firms in the US, Japan and Europe are currently devoting a tremendous amount of research effort to developing the technology. RCA in the US and Marconi in England, the pioneers in the field, are now sharing the field with more than 60 other companies.

Fairly obviously, this activity would not be taking place if the companies concerned did not believe that liquid crystals have a big future in the commercial sense. And the directions in which research is heading certainly suggest wide application for the technology: watch, calculator and instrument readouts, flat TV displays, light amplification, data storage, precision thermometry, thermal imaging, radiation detection, and many other such roles.

True there are problems to be solved, not the least of which is to produce devices having a usefully long life. But as our feature article in this issue relates, at least some researchers are confident that the problems will be overcome very shortly. The indications are that when this occurs the technology will really take off, perhaps ultimately proving as significant as semiconductors.

It is certainly an area in which we can expect some interesting developments.

On another topic, a long-standing disappointment of mine is the way in which so many people have been, and continue to be alienated by science and technology. Whatever the reasons — and they probably include mediocre science teaching in schools, bad PR by research institutions and plain old anti-intellectualism — it is surely rather sad that so many people have such a negative and apathetic attitude towards scientists, engineers and their endeavours.

I was therefore quite cheered a few days ago to see a report in our associated British journal "New Scientist" of the great success met by the 1972 Christmas Lectures given by the Royal Institution. Dealing with the subject of radio communication, they were presented by senior BBC engineer Mr Geoffrey Gouriet, and broadcast to the public.

There is so much that could be done along these lines, in an effort to popularise science and technology not only for the young people about to choose a career, but also for the many adult members of our society who are its beneficiaries (and occasionally, its victims).

With a science unit equipped to tackle this field, the ABC could well consider producing more and better programs of the type that are needed. And not just radio programs, but TV productions also — they would after all be "local content."

— Jamieson Rowe

ON SALE THE FIRST MONDAY OF EACH MONTH

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NEWS HIGHLIGHTS

$50,000 Award for inventor of major breakthrough in X-ray

One of Britain's major engineering awards, the MacRobert Award, has been presented to Mr Godfrey Hounsfield, the inventor of the new EMI X-ray system for diagnosing brain diseases.

Mr Hounsfield, seen here with the machine, was presented with a cheque worth $50,000 by Prince Phillip for the technical innovation that most significantly "contributes to Britain's prestige".

The award's gold medal went to EMI, and was received by Sir Joseph Lockwood, Chairman of EMI at the same ceremony. Submission of the scanner for the MacRobert Award was prepared by EMI, who stated "The EMI-SCANNER was as much a one-man invention as anything can be these days."

Since the EMI-SCANNER was introduced earlier this year, orders have been received totalling nearly $1.2 million, of which $800,000 worth have come from the USA.

The EMI-SCANNER is a system of computerised axial tomography. The patient's brain is examined as a series of layers by a scanning unit housing very sensitive X-ray detectors. These record the X-ray photons passing through the brain. In four minutes, during which time the fully-conscious patient relaxes on the examination table, the scanning unit is rotated around the patient's head in 180 one-degree steps.

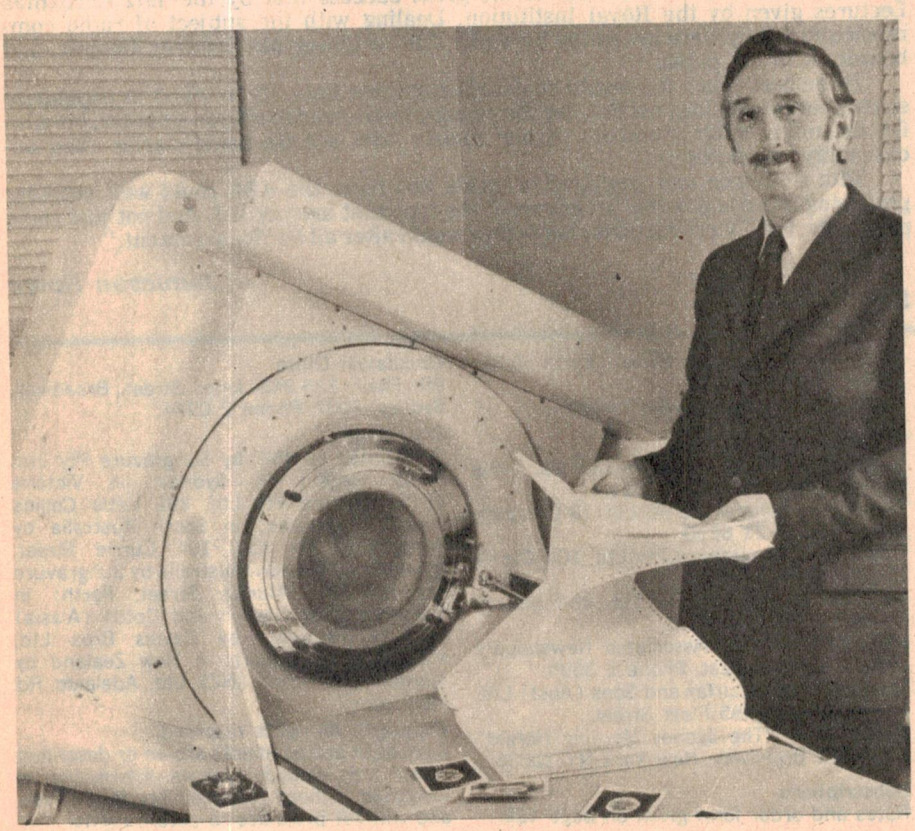
At each step, 160 accurate readings are taken of brain tissue absorption characteristics from a narrow beam of X-rays. The resulting information is fed to a small computer which calculates the 28,800 readings taken from each layer. From these calculations it produces a picture on a cathode ray tube, made up as a matrix of 6,400 picture points. Each 3mm square point represents the X-ray absorption coefficient of the brain tissue as that point in the patient's head, calculated to 0.5 per cent accuracy.

The picture becomes available approximately 6 minutes after the patient has been scanned. It may be studied on the CRT screen immediately or may be recorded photographically for later examination.

The results may also be printed out as a pattern of numbers, to give accurate and detailed information on the brain tissue at each point in the patient's head. This provides an important alternative aid to the diagnosis of certain conditions.

As well as providing 100 times more information on the brain tissue than is possible by conventional means, the EMI system avoids the need for skilled medical staff to be in attendance and eliminates factors which make it necessary for aptients to spend time in hospital either before or after a brain examination, such as radioactive injections.

In his citation for the award, Lord Hinton, Chairman of the Award Evaluation Committee, said: "One of the medical referees consulted during the evaluation stated that no comparable discovery has been made in this field since Roentgen discovered X-rays in 1895, and we agree with him."



Earth station for India

The Electronics Corporation of India Limited, Hyderabad, has been given the contract for construction of the antenna and servo system for the satellite communication earth station project at Dehra Dun which is being set up by the Overseas Communication Service (OCS).

The antenna is part of a $7.8 million earth station project at Dehra Dun, and will cost over 1.1 million dollars.

The antenna will consist of a 97-ft diameter parabolic disc weighing over 300 tons and will have a pointing accuracy of .01 degree. It will be fabricated entirely by Indian engineers and will have 80 per cent local content.

It is expected to be installed in 1974 so that it can be utilised during the National Aeronautics and Space Administration (NASA) and Department of Atomic Energy (DAE) experiments using the ATS-F satellite for the Satellite Instructional Television Experiments (SITE) for a period of one year.

The Dehra Dun earth station is expected to be commissioned for commercial operation early in 1975.

$1-million component export order

Centre Industries, the research, training and manufacturing facility operated by the Spastic Centre of NSW, has just announced the receipt of semiconductor device export orders totalling $1-million for delivery during 1973. This is believed to be the biggest export order package for professional components ever received by an Australian manufacturer.

The orders are for A-14 glass passivated silicon rectifier diodes, which Centre Industries make under license to General Electric in the US. Naturally CI is proud of the achievement; as deputy General Manager Bert Israel puts it, "We feel it shows just what Australian manufacturers can do if they get off their sterns and out into the international marketplace. This is after all the only way to get the volume of orders needed to be fully competitive in producing this type of professional component."

CI is now running three shifts on their semiconductor production line at the factory in Allambie Heights, just north of Sydney, in order to fulfil current domestic and export order commitments. First shipments of the new orders have already been despatched.

Bert Israel is confident that further orders for the A-14 devices will be received during the year, and stresses that the $1-million figure is only the start. CI also plans to add further products to their semiconductor range later in the year.

Decca gold disc for Garrard record player

An inscribed gold disc, the record industry's traditional way of commemorating a million seller, was presented to Garrard at the recent International Audio Fair in London. The award marked the production of more than one million Garrard SP25 record playing units.

Mr Geoffrey Bowden, general manager of Garrard, said: "We believe that this is the first time that production of one model of a Hi-Fi single player unit has reached the magic million mark. When the SP25 was introduced, it brought advanced design trends to the medium prices equipment market, and has without doubt proved to be the most popular unit ever produced in the audio separates field, both in the UK and overseas."

In addition to facilities for manual operation, the SP25, illustrated at left above, has a lever type cue and pause system with fluid damping. Stylus force and bias compensation are also adjustable.

The gold disc was presented to Mr Bowden (left below) by composer and musician Frank Chacksfield (right) on behalf of Decca.

Moon stations still active

Although America's manned exploration of the Moon has ended for the forseeable future, an extensive, nuclear-powered scientific network will continue to send live reports back to Earth for at least two years.

Apollo 17 astronauts established the fifth independent experimental station, bringing the total number of operating experiments to nearly two dozen. The instruments in the network measure such things as tremors beneath the lunar surface, heat radiating from within the Moon, gravitational and magnetic forces, and particles in the lunar atmosphere.

Most of the earlier experiments had a life design goal of one year, but four of the five instruments carried by Apollo 12 continue to return information more than three years after they began operating.

All five stations include seismometers to record tremors caused by meteoroids, tidal stresses, and internal changes in the Moon. Because the moon is extremely quiet, the seismometers register shocks far smaller than would be noticeable on Earth.

The seismic network is providing a wealth of information about layers far beneath the Moon's surface.

Even though there is a nearly perfect vacuum on the Moon, a variety of instruments measure the constantly changing lunar atmosphere. Solar winds, gases escaping from beneath the surface of the Moon, and dust thrown up by the impact of meteoroids all contribute to matter in the atmosphere.

A third attempt to measure the heat flowing from the centre of the Moon will be made with an experiment set up during Apollo 17. Sensors were placed in holes drilled 2.4 metres ($8\frac{1}{2}$ feet) into the lunar crust to provide regular readings.

The final group of five experiments for the Apollo 17 landing site have a life design goal of two years, twice as long as the earlier packages. They may operate much longer.

No one knows when the five stations may stop sending back data from the Moon, but their nuclear-powered generators may still be providing energy well into the twenty-first century, far longer than the experiments themselves will survive the cycle of extreme heat and cold of the lunar surface.

Antenna safari to Darwin

A convoy of equipment for the installation of antennas on the 1400-mile Mt Isa to Darwin telecommunications link has arrived in Mt Isa from Andrew Antennas Pty Ltd in Melbourne. A special electronic measuring equipment van is included, along with power plant, mobile kitchens, office, coolroom and sleeping accommodation. Andrew Antennas will use the equipment to install 105 microwave antennas on 48 towers and a waveguide feeder system for the link.

Here's $330 value for only $213.50 OR LESS!

The SANSUI 210A

And your new Sansui Model 210A stereo tuner amplifier will possibly cost you even *less*. What do you get? A powerful solid state stereo amplifier rated at 22 watts R.M.S. and worth *not less* than $150.

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NEWS HIGHLIGHTS

Lasers as standard production tools

Programmable resistor trimming laser for IC production allows automatic trimming of up to 47 resistors at a time.

Union Carbide's Korad Department in California has announced three new products which clearly demonstrate the progress of the laser from a laboratory curiosity to a standard production tool.

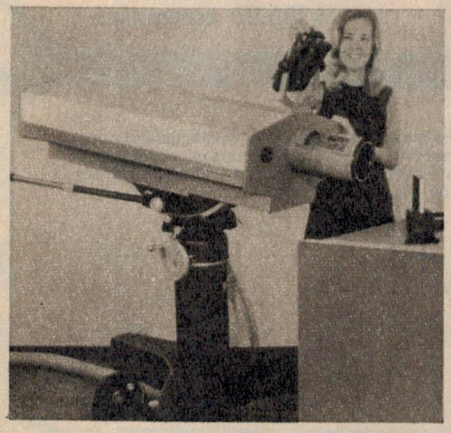
The new laser products, which are aimed at three completely different areas of manufacturing or production, are a portable holographic camera, a laser trimmer for microelectronic resistor fabrication and a laser amplifier for high level energy applications.

Designed to offer industry a new and complementary technique to existing non-destructive test methods, the portable Korad Model KHC1 Laser Camera takes holographic testing out of the laboratory into production areas where practical non-contacting reflection or transmission holographic diagnostic techniques can be used. Reflective holography can be used in such applications as the detection of flaws in structures, composite panels, honeycomb materials, pressure vessels, tyres and high performance materials.

Transmission holography provides a three dimensional record for particle sizing and distribution studies, flow visualisation, fibre sizing, plasma diagnostics, electrochemical reaction studies or ballistics studies, where the laser's 20 nanosecond exposure time is ideally suited to "freezing" moving particles on a permanent hologram for convenient analysis. Optional photographic film systems for use with the KHC1 will produce a permanent record of any test, with a dry-to-dry development time as fast as 20 seconds.

Portability results from the design of the tripod-mounted camera which incorporates a pulsed ruby laser, all holographic optics, plus the holographic plate holder in a single enclosure. Because of its 20 nanosecond exposure time, a pulsed ruby laser is used as the light source, eliminating the need for bulky and expensive vibration isolation systems.

"Portable" holographic camera used for non-destructive testing.



Korad's KRT Laser Resistor Trimming System allows the trimming of microelectronic thick film or thin film resistors on a production line basis. A programmable module permits preselection of values for up to 14 resistors (48 probes). A second module may be added for automatic trimming of up to 47 resistors at a time (94 probes).

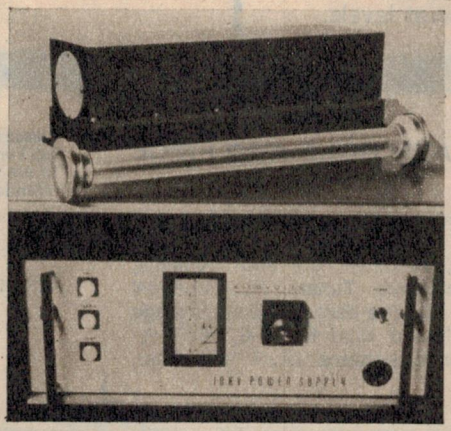
The program module is programmed by the use of plug-in resistor boards and a plug-in patch panel. The complete system can be programmed either "on line" or "off line".

During the trimming operation a simple switch allows the operator to electronically scan all of the probes and resistors without changing the position of the laser beam.

For those who need power, Korad's new K10 helical laser amplifier is designed to greatly amplify the energy output from previous stages of high-energy pulsed laser systems.

Application potentials include any situation that requires extremely high-energy generation, such as; thermal diffusivity studies, lunar ranging, shock propagation studies, plasma generation and laser-induced fusion, to name a few.

Laser amplifier head can withstand 25,000 joules of stored energy per pulse.



The laser rod is pumped by five helical flashlamps, each of which has an independent energy storage bank. The advantage of this design to the user is that the system then uses five short, inexpensive lamps capable of generating a short pulse width in harmony with the short fluorescent lifetime of the Neodymium ions. These flashlamp pulse durations can be as low as 550 usec for maximum efficiency consistent with good flashlamp lifetime characteristics.

Fabricated from an aluminium base plate and cover, this water-cooled, solid-state laser head can easily withstand a total input of 25,000 joules of stored energy per pulse. As a safety feature, the electronics of this system are designed so each lamp can only receive its stored energy from its individual capacitor bank. As a result, the possibility of a lamp failure due to over-driving is eliminated.

New black matrix tubes

A simplified method of making black matrix colour TV tubes has been revealed by Matsushita Electric (National) in Japan. The company used the method for the first time when making their new 20-inch BM colour tube with 110 degree deflection.

Known as the "direct exposure method", it eliminates the formerly used process of re-etching the shadow mask holes after the fluorescent dots are printed.

The re-etching is required in the conventional method because the shadow mask is used to print the dot pattern on the inside of the tube face. Since the holes in the shadow mask must be larger than the fluorescent dots, for proper focusing, the mask must then be re-etched to enlarge the holes. With the "direct exposure method" dots which are smaller than the shadow mask holes can be printed directly from the final mask.

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40 Watts RMS per channel

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- Includes built-in 4 channel adaptor unit, which with aid of 2 extra speakers, enables one to replay 4-channel records or tapes.
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- Power Bandwidth (IMF) is 8 Hz to 50KHz, at less than 0.5% total harmonic distortion into an 8 ohm load.
- Contains five inputs, with input sensitivity of 3mv for phono, and .13V for high level, for 40 watts RMS output.
- Dimensions 13½" x 4¼" x 11½".

Price **$299.00** kit
$399.00 assembled.

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E302

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The *FULLY GUARANTEED* amplifier kits.

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- Frequency response from 10Hz to 100KHz ±0.5db.
- Total harmonic distortion at rated 2 volt output is less than 0.05% at 20Hz to 20KHz.
- Includes 3 position high-filter switch as well as low-filter.
- Ideally matches the Dynaco Stereo–80 or Stereo–120 power amplifiers.

Price: **$169.00** kit
$259.00 assembled

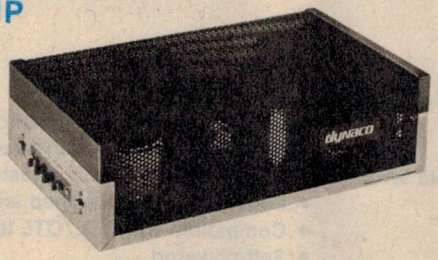
DYNACO QD1 QUADAPTOR

The Dynaco Quadaptor serves as a control unit between any stereo amplilfier and four speakers to recover the four separate signals from two stereo channels. This means that you can faithfully reproduce the original concert hall sound or "ambience" in stereo recordings by means of four dimensional reproduction. Ambience is normally lost in a conventional two-speaker system.

The Quadaptor measures only 4¼" x 4½" x 6¾", yet makes such a difference to any existing stereo system.

Price: **$35.00** kit
$49.00 assembled

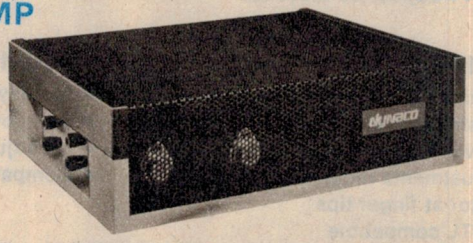
DYNACO STEREO 80 POWER AMP



- 40 watts RMS per channel power amplifier measuring 14" x 8" x 4".
- Total Harmonic Distortion is less than 0.5% at any power level up to 40 watts RMS per channel into 8 ohms at any frequency between 20Hz and 20KHz with both channels driven.
- Semiconductor complement of 12 transistors and 10 diodes.

$220.00 kit
$259.00 assembled

DYNACO STEREO 120 POWER AMP



- 60 watts RMS per channel with regulated power supply, this power amplifier measures 13" x 10½" x 4".
- Total Harmonic Distortion of less than 0.5% at any power level up to 60 watts RMS per channel into 8ohms at any frequency between 20Hz and 20KHz.
- Semiconductor complement of 15 transistors and 15 diodes.

Price: **$290.00** Kit
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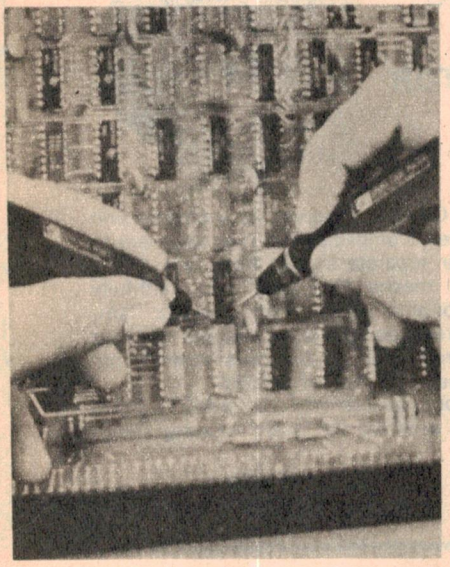
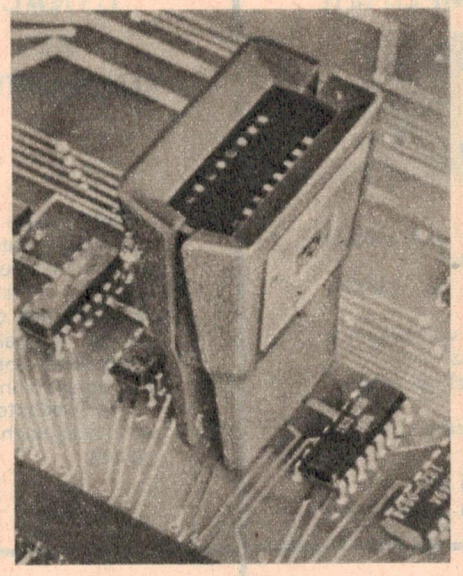
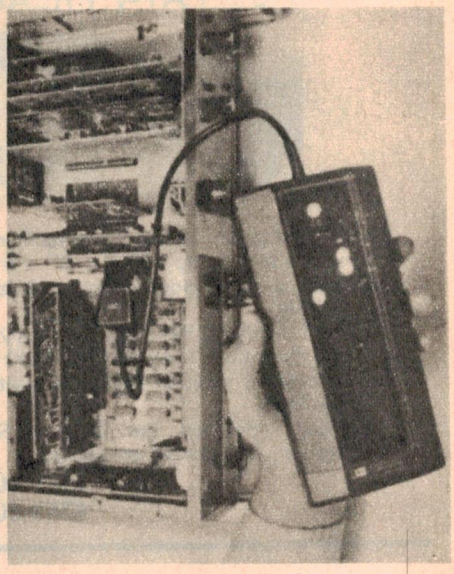


Logic probe and pulser



Logic clip



Logic comparator

Model 10525T Logic Probe
- Dynamic indicator of logic activity
- Pulse stretching for pulses down to 10 ns
- Bad level detection
- No adjustments required
- Indicator at finger tips
- TTL/DTL compatible
- Safe overload protection

10526T Logic Pulser
- In-circuit stimulation without unsoldering
- Automatic injection of proper polarity pulse
- Greatly simplifies digital troubleshooting
- Output protected against overload
- TTL/DTL compatible
- Enhances utility of Logic Probe and Clip

Model 10528A Logic Clip
- Displays IC logic states at a glance
- Self-powered, self-contained
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- Compatible with TTL/DTL logic levels

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NEWS HIGHLIGHTS

Multi-media show at Randwick Tech

An ambitious and unusual end-of-year exhibit was given at the Interior Design School of Randwick Technical College (Sydney) in December. Final-year student Mervyn Beamish designed and organised construction of a complex electronically controlled sound and light show which turned out to be as sophisticated as any in the world. The show was housed in a geodesic dome designed and built by a fellow student, Tim Winters.

Purpose of the display was to demonstrate Mr Beamish's theories about the use of multi-media displays as an integral part of interior design, so that the mood of a room can be selected for the occasion by use of moving patterns, pictures, lights and music.

He was able to enlist considerable professional help to prove his point. Audience Motivation of North Sydney put together the "software" package with slides taken by photographer David Beale. The electronic control equipment, slide projectors, mirrors and special effects lighting were supplied by Convoy International of Sydney.

The projection and control system was constructed with the help of Eric Gidney, an experienced multi-media design engineer from Convoy International. The basic projection set-up consisted of five sets of three projectors each, which showed images simultaneously on the inside walls of the dome to create a "total environment" effect. The show was divided into segments, each of which was accompanied by music, ranging from the Bernstein Mass, through Strauss and Burroughs to Stockhausen the German composer of electronic music.

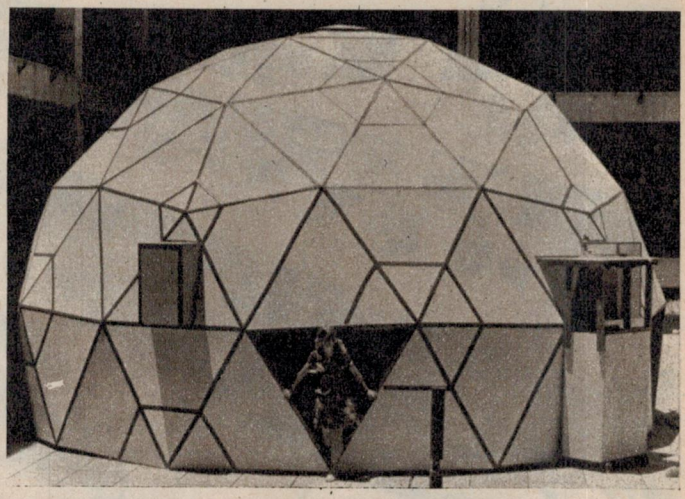
Besides the still images projectors, which were controlled by dissolve units, one projector in each group was directed into a rotating warped mirror which created constantly moving and undulating images. Even the floor was covered with moving light patterns.

Controlling all this was a small special-purpose computer, made by Electrosonic in the UK, which can encode and decode 24 channels of control instructions onto one track of ¼in tape on an ordinary audio tape recorder.

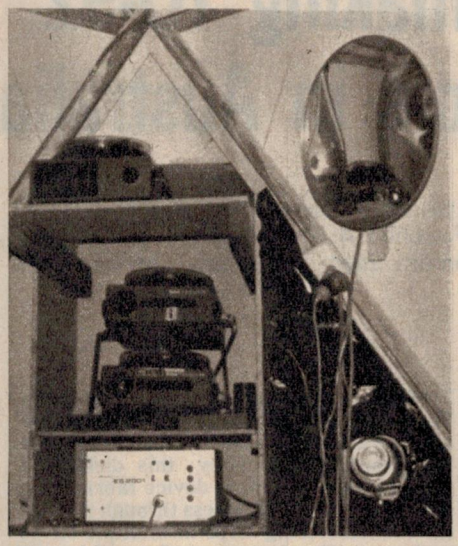
Information is time-division multiplexed on a 5kHz carrier using a tone pulse system for recording, and then replayed and decoded into discrete channels for controlling projectors, faders, lights and sound functions of the display.

The Electrosonic system is especially designed to eliminate spurious error signals often associated with tone pulse systems. Its digital circuits apply a "degree of absurdity" test to all commands and double check any two successive commands to see if they are logically compatible.

Provided the program has been recorded correctly the decoder will function correctly even with a signal level variation of 25dB either side of nominal level. Individual tape drop-outs do not affect the system except occasionally to cause a function to operate a fraction of a second late. Programs may be recorded on Compact Cassettes or 8-track cartridges as well as on reels.



Geodesic dome 17ft high was built for the exhibit in courtyard of college. Scenes were shown directly on inner walls of dome — a typical "corner" is shown at right. Show was organised by Mervyn Beamish (below).



Typical projection station, one of five, comprised three projectors, lights, a dissolve control and a warped, rotating mirror. Two projectors were focused on the same opposite wall and the top one on the mirror.

1973 IREE convention

The Institution of Radio and Electronics Engineers has issued a call for papers for presentation at the 14th National IREE Convention, to be held in Melbourne, August 20-24, 1973.

Papers may be reports on completed work, present thoughts on some topic, survey or general review papers, or a very limited number of up-to-the-minute reports on new work. Notification of intent forms must be received by March 30, 1973. Forms are available from IREE, Science House, 157 Gloucester Street, Sydney 2000.

Receiver on a chip

Ferranti's new ZN414 silicon network provides a complete 10-transistor TRF radio circuit on a single chip in a standard 3-pin package. All that need be added for a complete receiver is a battery, earphones and antenna, plus a tuning capacitor and two fixed capacitors.

By addition of a simple power amplifier the ZN414 can be used with a loudspeaker.

If layout criteria are followed, the chip provides a stable receiver circuit with no requirement for setting up of oscillator or IF coils. Built in AGC is provided which is variable if required. Total harmonic distortion of less than 1 per cent is claimed.

The device is made by the collector diffusion isolation process developed recently by Ferranti. Ferranti is represented in Australia by Noyes Bros Pty Ltd.

Fairchild now making TO-92 plastic transistors in Australia

A new manufacturing line for moulded plastic transistors in the Jedec TO-92 package is now in full production at Fairchild Australia's plant in Croydon, Victoria. Most of the production equipment used in the new line has been made by Australian manufacturers.

by JAMIESON ROWE

The new line has been turning out commercial quantities of TO-92 moulded plastic devices for some weeks now. Most of the output has been going in large orders to commercial customers, but the products are being released to the general market this month. Approximately 10 different types of product are currently being made in the TO-92 package, including both bipolar transistors and JFETs.

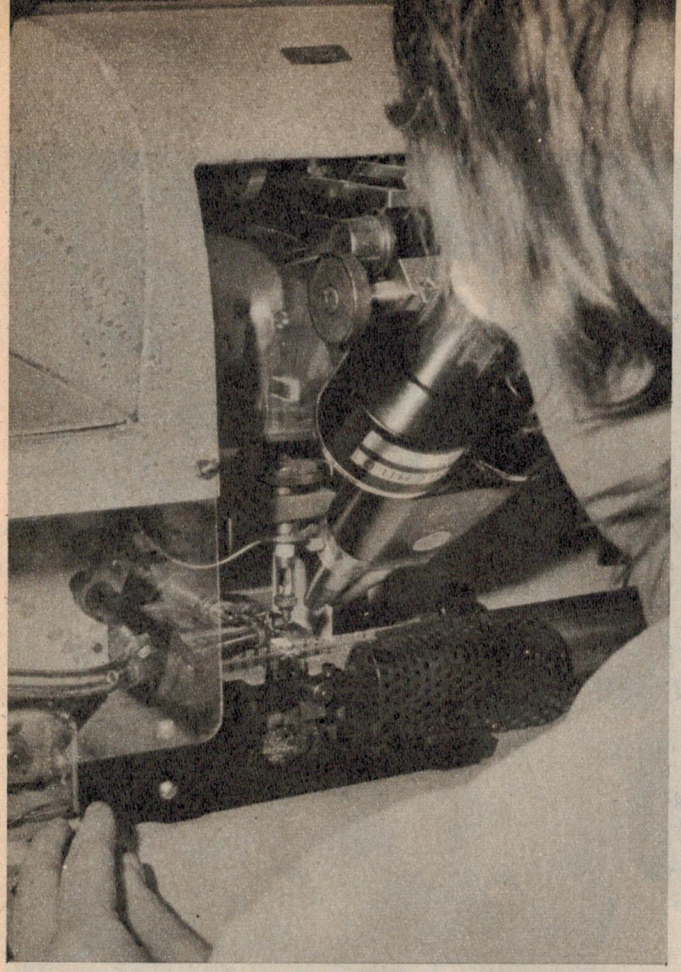
In most cases the new devices are electrically identical with existing devices marketed in the familiar TO-5 and TO-18 metal can or epoxy "glob-top" packages. As far as the end user is concerned, the main difference is that they come in a characteristic moulded silicone package, which is half-round in cross section and roughly the same size as a TO-18 device.

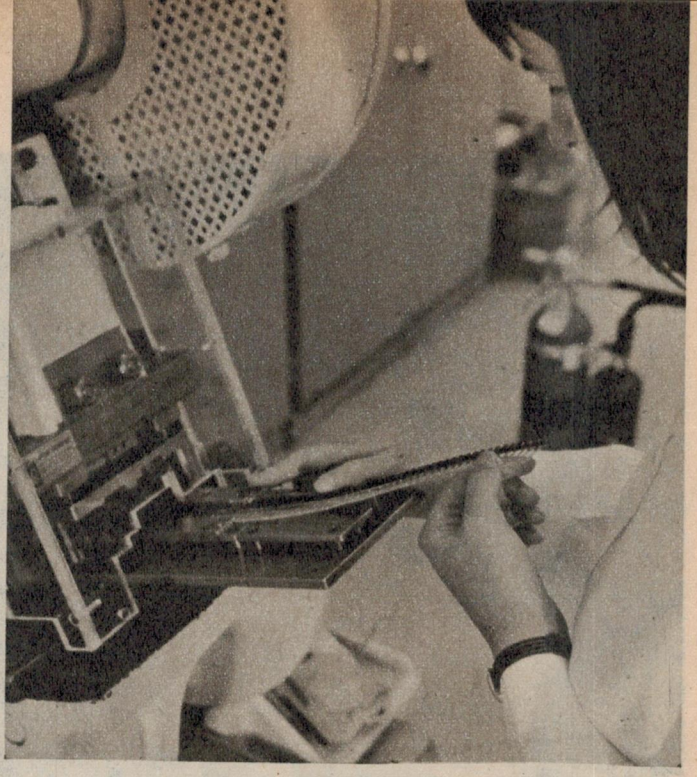
From the manufacturing viewpoint, there are more important differences between TO-92 devices and metal can or epoxy types. For economical plastic moulding, devices must be grouped together in batches rather than handled separately; this dictates a lead-frame approach to device fabrication, where the devices progress through most of the manufacturing steps in multiple strips or frames. The frames are formed by the metal lead / header assembly of the individual devices, held together by metal links which are punched away only at the end of the production process.

A big advantage of the lead-frame approach is that it cuts down on the handling time required for most manufacturing steps. Operations like die-attachment and wire bonding can thus be made more speedy and efficient, with the operator no longer having to load and unload individual devices. Lead frames also lend themselves far more readily to process automation, both because the headers are uniformly spaced and orientated, and because the frames are readily indexed and incremented.

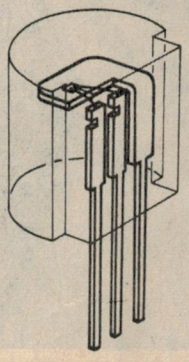
In their new line Fairchild are using 50-device lead frames, measuring about 285mm in length. The frames are punched and formed overseas from a special copper alloy, selected for its low thermal resistance, and are gold-plated locally before use. The use of a relatively long frame permits production rates of typically 600 devices per hour for die attachment, 400 per hour for wire bonding, more than 5,000 per hour for plastic moulding and 12,000 per hour for final cropping apart.

Fairchild Australia's production engineer Frank Fimmel designed the new TO-92 line and supervised all aspects of its setting-up. When I talked to him recently at the Croydon plant, Frank was justifiably proud

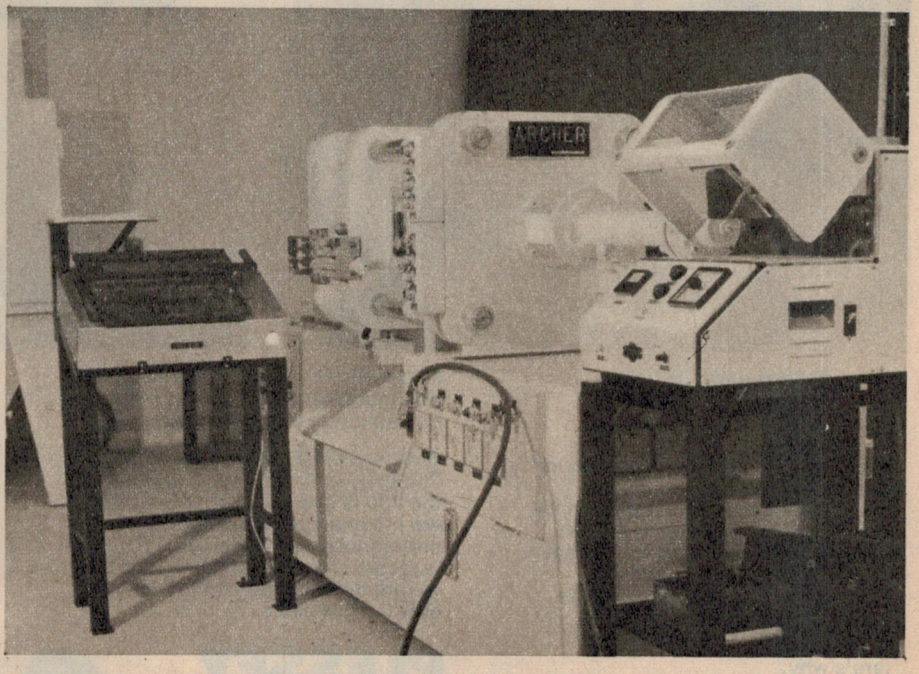




Picture at top of opposite page shows the main bonding and assembly lines at Fairchild's plant in Croydon. The lines which have been converted for TO-92 are at extreme right. At left on this page is a close-up of a wire-bonding station, showing a leadframe under way. Above is the cropping and shearing press, which divides the frames up into individual devices at the rate of 12,000 per hour. Below is the moulding press, with frame preheater at left and dielectric heater for the moulding pellets at right.



GHOST VIEW OF FAIRCHILD TO-92 PACKAGE



of the project, for two main reasons. One was that he had been able to set up the line in a considerably shorter time than similar overseas lines, and for a cost only a third as great.

The other reason was that he had been able to obtain most of the new equipment from Australian manufacturers. The plastic moulding press was manufactured by Archer Hydraulics, of Stanmore in Sydney; the impregnation equipment by Dynavac, and the de-flashing equipment by O. Granowski, both of Melbourne; and the cropping and separation press by John Heine, of Sydney. All of these manufacturers had made similar equipment before, although this was the first time that each had made equipment for transistor manufacture.

Early production steps such as die attachment and wire bonding are much the same for TO-92 devices as for metal can types, except that the operations are carried out on the lead frames. After wire bonding the frames are thoroughly cleaned by washing in de-ionised water, which prepares them for plastic moulding.

Fairchild's moulding press handles two lead frames at once — i.e., it moulds 100 devices at a time. The frames are supported in carriers, and are pre-heated in the carriers prior to loading in the press.

Pellets of the special silicone moulding compound used in the press are pre-conditioned in a 1kW dielectric heater, which reduces them to the consistency of soft putty. They are then inserted into the injection system of the press, after the moulding dies are closed around the

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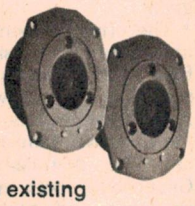

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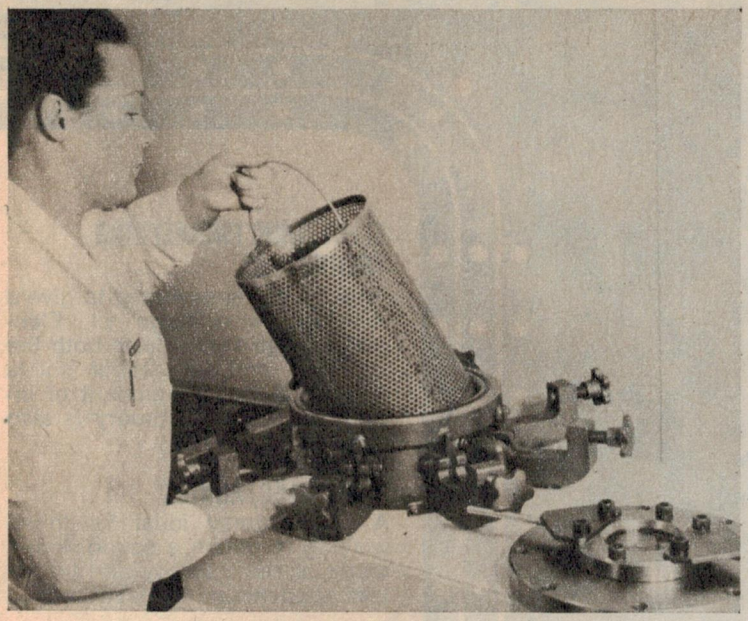
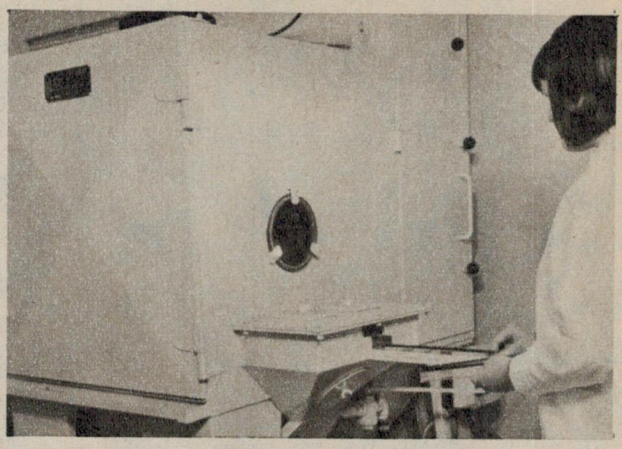
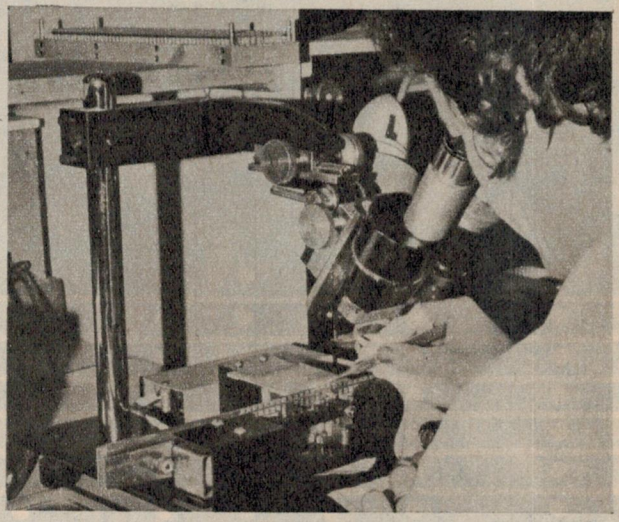


Impregnation with silicone resin, for hermetic sealing.





At top right is the deflashing station, where excess plastic swarf is removed by blasting with walnut shell powder. At right is a die attachment station.

transistor lead frames. The moulding itself then takes place after the operator activates dual interlock buttons, which are designed to prevent accidents.

Following moulding the frames are baked in an oven at 200 degrees C to harden the encapsulation, and de-flashed by blasting with a stream of crushed walnut shell particles. After this they then undergo a pressure impregnation process, in which a special silicone resin is forced into the moulded plastic under high pressure to ensure hermeticity. The special silicone resin used for the impregnation is imported and very expensive — $90 per gallon. After impregnation the frames are baked a second time to cure the resin and complete the hardening of the encapsulation.

Final step in the actual manufacture of the devices is cropping, performed by a very accurate punch and die set in a mechanical press. Here the metal links which joined the leads of the devices together in the lead frame are sheared away, separating them into individual units at a rate of 200 per minute.

As with other devices, the TO-92 transistors then progress to the testing and sorting section, where automated testing equipment under computer control sorts them into the various device categories corresponding to programmed parameter range combinations. They then pass through Quality Assurance to final marking and packing ready for despatch.

In getting their TO-92 line going, Fairchild have had to master the two main problems associated with plastic moulded semiconductor devices. The first of these is protection of the actual device chip and its wire leads, both during the moulding process and the subsequent curing. There is a tendency for the wire leads especially to be "washed away" by the flow of plastic during moulding, and also for the leads to be broken by strain produced by plastic shrinkage during the curing.

Part of Fairchild's solution to the wash-away problem is the detailed design of their lead frame, which has the chip sited on top of a small horizontal bracket formed at the top of the collector lead. Besides supporting the chip and helping to lock the assembly inside the moulded package, the bracket also tends to deflect the flow of plastic away from the chip and its leads.

But Frank Fimmel tells me that the shape of the lead frame is only part of the story. The exact design of the moulding dies is quite critical, together with the temperature and pressure used. And the composition of the moulding compound is also critical, not only with regard to wash-away but also to minimise shrinkage strain. It is not surprising that the silicone moulding compound used is actually the most expensive part of a TO-92 device, in terms of actual material cost.

The second problem which has traditionally plagued moulded plastic devices is the difficulty in obtaining true hermeticity. Fairchild are confident that they have licked the problem with their pressure impregnation process, and extensive testing by their Q & A department justifies their confidence. Naturally most of the answer must lie in the impregnation resin, and they aren't giving away any secrets; but it must be a rather special brew at $90 per gallon!

Apart from involving mastery of the two traditional problems associated with moulded plastic devices, Fairchild believe their TO-92 devices are exceptionally rugged both in the mechanical and electrical senses.

Some moulded packages have been notorious for either losing leads completely, or allowing sufficient lead movement to cause faulty operation. To obviate this problem Fairchild have designed their lead frame so that each of the three leads for a device is doubly locked into the final moulding, and prevented both from being withdrawn and from moving.

The special copper alloy used for the leads and the carefully tailored thermal coefficients of the materials in the overall package make Fairchild's TO-92 package particularly rugged in the electrical sense compared with a comparable size device such as the TO-18 globtop. Normal dissipation rating is 625mW, but extensive tests have shown that short-term overloads of much higher magnitude can be carried without damage. Some devices have operated at 2.5 watts for more than 3 hours before finally succumbing!

Fairchild are predicting that globtop devices will be progressively phased out by TO-92 products within the next 2-4 years, and that the lower production costs of TO-92 compared with metal can products will result in eventual domination of the low power discrete device market. In short, the future of TO-92 seems very bright.

Although they have announced general plans to expand the range of TO-92 products as the market develops, Fairchild aren't commenting on other possibilities for plastic moulded devices. No doubt the current deliberations of the Tariff Board will influence future plans, but my guess is that plastic moulded ICs might be next.

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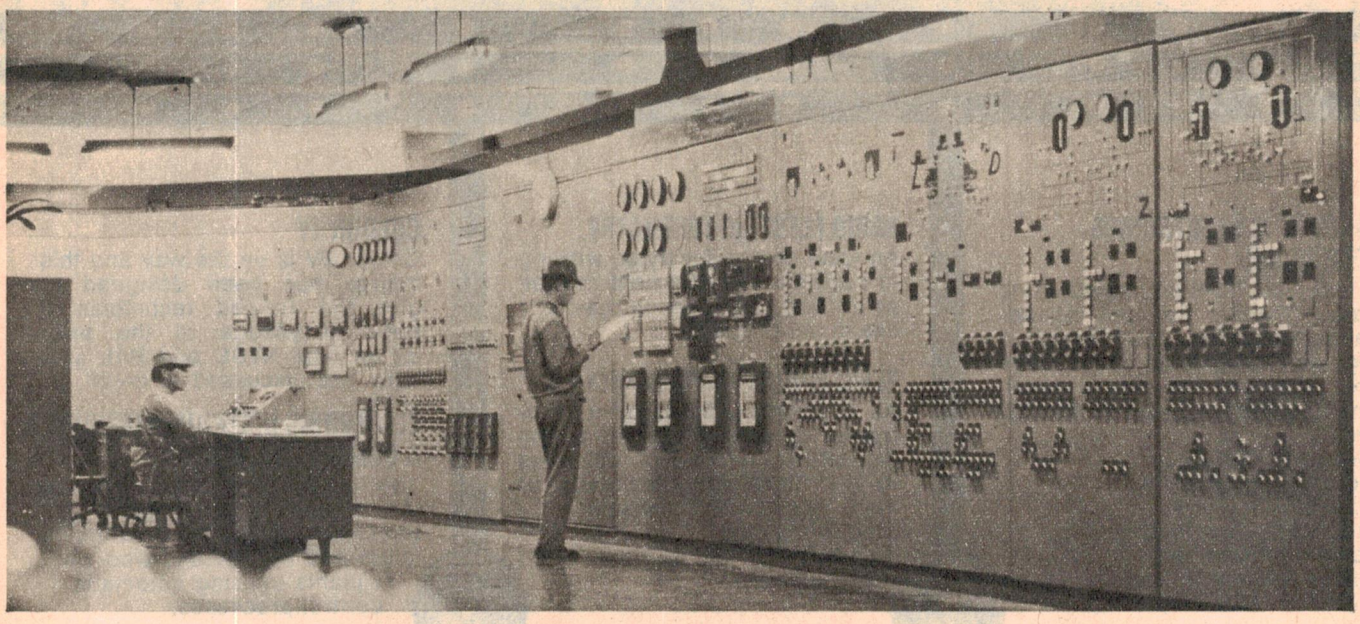

Automation in Japan

The Japanese electronics industry is rapidly overtaking the Americans in the fields of automated factory machinery and industrial robots. With active government aid now assured, the Japanese may soon be the world leaders in automation. Gene Gregory reports from Japan.

The central place of labour saving equipment in Japan's industrial policy for the 1970s has led to the emergence of new industrial systems, fashioned around the computer and other electronic control and measuring equipment.

New power stations have already been superautomated and are operated almost unmanned.

Since 1965, a highly integrated production system has emerged as one machine after another has been adapted for numerical controls.

Fujitsu, by far the largest numerical control (NC) device manufacturer in Japan, with its market share better than 80 percent of the total, put on stream one of the largest numerical control plants in the world in July 1971 with an annual production capacity of 4,000 units — twice the company's previous production.

Not long after the opening of the new plant, in September 1971, Fujitsu announced the licensing of its patented technology for an open reel NC device equipped with a pulse motor to the Bendix Corporation of the US, in what must be taken as a sign of things to come in advanced automation technology from Japan in the future.

This development has special global import, if for no other reason than that Bendix was the first company in the world to develop numerical controls. The fact that Japanese knowhow has surpassed that of the US in this particular field of technology is a dramatic counter to the old saw that the Japanese are merely copiers, incapable of significant innovation.

Fujitsu produced its first numerical control device, retrofitted to a turret punch press, in 1956, four years after the first Bendix-equipped NC machine tools made their public appearance at the Massachusetts Institute of Technology in 1952. Since then Fujitsu has emerged as the leader of Japan's numerical control industry, supplying virtually all the requirements for NC devices of Japanese machine tool builders.

But Fujitsu is far from being alone in the field: Tokyo Shibaura Electric (Toshiba) has wedged itself into the Japanese market with GE's Mark Century series of equipment, and Oki Electric, which has entered the field with recent technology obtained from Bendix, has added a new series of NC devices for use in small machine tools. Mitsubishi Electric has begun bolstering its NC machine development department, increasing its monthly production to 50 units during 1971.

Apart from the computer manufacturers, some machine tool manufacturers also have entered the race for what has become one of Japan's most rapidly expanding markets, but mainly to produce NC control devices for use on their own machines.

The outlook for the industry was considerably enhanced when, late in 1970, the Japan Machine Industry Promotion Association announced the development of a collective control system for a group of NC machine tools.

The new system features the ability to control many kinds of NC machine tools at the same time, using real time control which distributes instructions from a central computer to the control unit of each machine. On-line automatic programming, including processing, correction and testing, can be performed by the new system. This on-line automatic programming can be done at the same time as several units of NC machine tools of different kinds are being controlled.

It is also possible to use the system for batch processing of production schedules and scientific calculations. Ultimately, when a large-scale time-sharing system is available, the new system can be used as a satellite computer system.

Hitachi Seiki has already successfully developed new group control technology which features unmanned operation of a machine shop — including carrying materials in and out.

The Seiki group control system is capable of multi-kind small-lot production, coping with disorder in production caused by revision of production plans or design, increase in options and so forth. With the on-line information processing facility, such things as material feeding, observation of production processes, and sorting of products can be automatically performed.

A similar system, developed through the joint research of the Japan National Railways, Fujitsu and Ikegai Machinery Works, is now being applied at the JNR's Omiya Factory, where the work of 20 highly skilled workers was done by four in the initial test run. Over 30 percent of the work in the 3,000-man factory is now being produced by group control systems.

Meanwhile, Oki Electric Industries has developed a new group system which is

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Also included are full details of a suitable speaker enclosure, a silk screened board, and all controls. The cost of the separate parts are a lot more than the total kit price —
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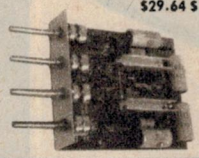

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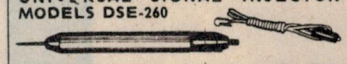

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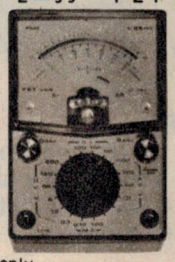

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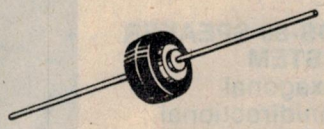

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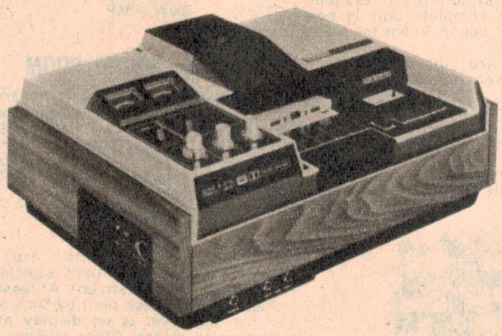

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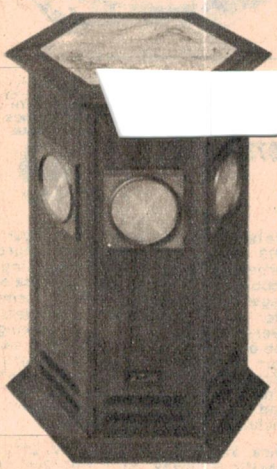

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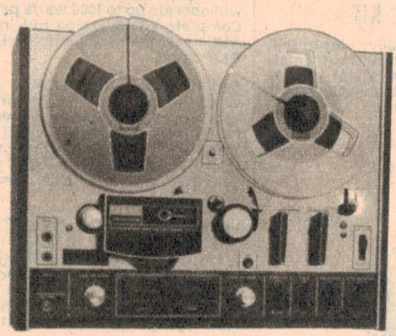

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capable of controlling 128 machine tools of different kinds at the same time, using a large-scale central processing unit.

While several manufacturers are developing similar systems, there are still some rather serious limiting factors on the growth and ultimate size of the market. First, a single system costs anywhere from $US300,000 to over $US1.5 million, which limits its usefulness to larger enterprises. But before such expensive equipment finds many buyers, some solution to the problem of reliability must be found. Quality control measures designed to cope with troubles in machine or electric systems have yet to be perfected.

Even after refining the operations of existing systems, so long as the group control technology applies only to production involving multiple operations for small lot output, it can meet only 20 percent of the market demand for machine tools, estimated in 1970 to be $US600 million in Japan. However, once the system is perfected for use in mass production with transfer and specialised machinery, the system will be able to cover 80 percent of the demand. At that point, the market potential is expected to expand by approximately five times.

While development of such equipment will require several more years, there has already been some progress in this direction. Machinery manufacturers have been exploring methods of applying new group control technology to simplified automatic machining lines from which significant labour-saving effects can be obtained at much lower initial cost. An NC transfer system developed by Osaka Kiko, for example, is composed of a 6-spindle NC turret miller, two NC milling machines, a power control panel for NC units, three industrial robots, a hydraulic unit for the robots, and a miscellany of peripheral equipment.

Development of industrial robots has already advanced to the stage where they are practical for handling simple, repetitious tasks or for doing certain kinds of work under conditions that are hazardous to human health or are extremely unpleasant.

The worsening manpower situation in the country has spurred an increasing number of automobile, industrial machine and other manufacturers to seek solutions to their problems with the introduction of robot machines, and a wide-ranging plan for the promotion of industrial robot development has been formulated. Contained in the Electronics and Machine Industries Law enacted in 1971, a fund in excess of $US100 million has been created to promote industrial robot manufacture and applications.

Special programs will be undertaken to develop systems in which robots will be incorporated for use in industry, through more extensive software development, to develop "unmanned" processing systems by combining the use of group-control machine tools and automated warehouses, and to carry out research and development on "unmanned" production systems and the most suitable robots for them.

For the most rapid development of automation technology and the promotion of its application in industry, the Japanese government and industry will create centralised information services, conduct research on standardisation and improving the reliability of important types of apparatus, foster co-operation in research between robot makers and makers of air and hydraulic equipment, as well as with electronic computer makers.

Work has already begun on the development of a high-efficiency robot which combines a mechanical robot and logical operation circuit, making the robot capable of perceiving such properties of matter as shape, colour, and hardness of objects, to note changes, make decisions and proceed with work. High performance robots are also to be developed with the power to walk and a position accuracy of within 1mm (scheduled for completion by 1974, at a cost of about $US3 million).

An industrial robot capable of recognising patterns is scheduled for production in 1977, at developmental costs of $US12.5 million. A special robot with pressure sensors capable of automatically controlling gripping or sucking power to hold objects will be developed by 1973 after expenditures of $US30 million. An undersea robot capable of working at 200 metres will be ready for the production line by 1976, with R&D costs of $US6 million. And a special group control system for handling whole platoons of robots is scheduled for perfection by 1977 at R&D costs of about $US10 million.

For the achievement of these goals a special Robot Makers' Conference has been established to put the plan into effect with the full co-operation of related industrial bodies, and thus to raise the industrial robot manufacturing industry as rapidly as possible to a high state of development.

Considerable progress has already been made during the past four years in the installation of automated warehouses, with the volume of sales estimated at $US60 million in 1970. As management becomes increasingly conscious of land costs and labour saving measures in the distribution sector become more widespread, the demand for equipment used in unmanned warehouses will increase.

While computer controlled conveyor systems have become rather widely used in some Japanese industries, unmanned warehouses are still in the development stage. Some automobile manufacturers have sought to introduce labor saving equipment in their warehouses, but totally integrated warehousing and production activities through the use of computers which control all functions are for the most part still in the planning stages.

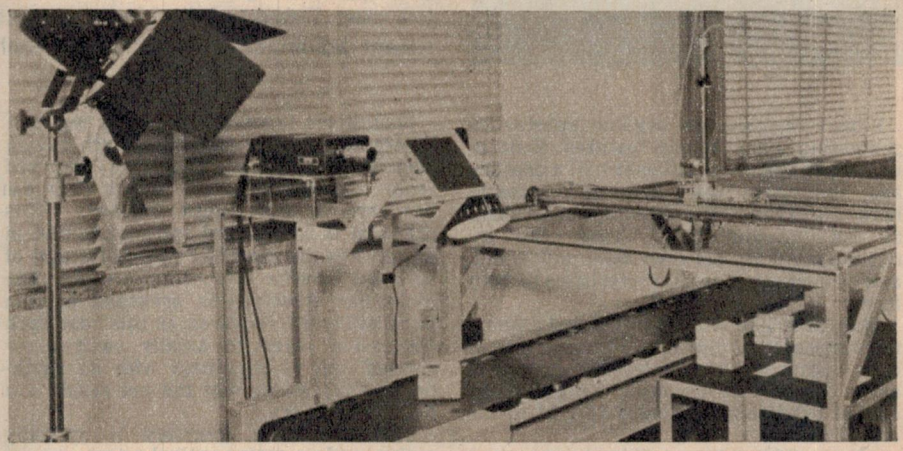
When plans are completed, Daifuku Machinery Works engineers claim, unmanned warehouses will cut manpower requirements and time in half; cut requirements for material handling equipment to one-third present levels; and reduce land needed for warehouse sites by one-fourth.

These are the major outlines of the incipient automation revolution in Japan. By 1980, the evidence suggests, Japan will be one of the most highly automated and systematised countries in the world, with a GNP not far short of the magic trillion dollar mark.

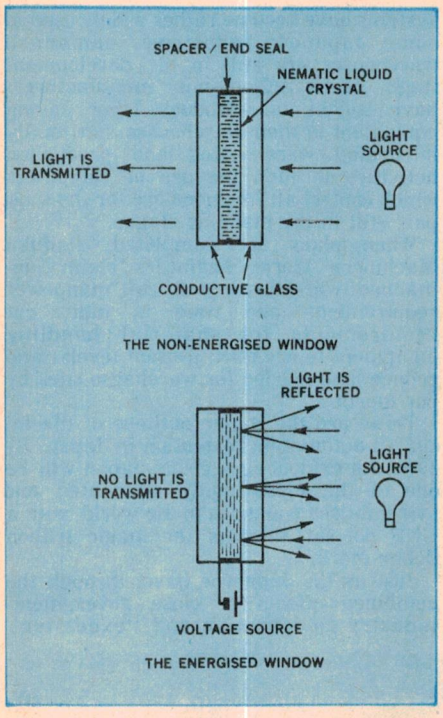
Just as the Japanese have, through the combined effects of close government-industry co-operation and "excessive" competition among companies, succeeded in capturing a leading position in the world electronic calculator market, all the elements would seem to be present for a similar performance in the field of automation, where the entire future of Japanese economic growth and international competitive power is at stake.

With these vital interests at stake, and with the objectives they entail, the Japanese effort in the field of automation and systems development is something akin to the US Apollo Project, where top national priority is given to research and development, government funding, bank financing and industrial production.

There is one fundamental difference, however. Rather than depend upon chance for useful spinoffs from an effort that has no direct relationship with everyday needs or market forces, Japan's drive to perfect advanced labor-saving equipment is totally geared to immediate, medium- and long-term needs of inhabitants on space ship earth, as it is propelled into the technetronic age.



THIS DOESN'T LOOK LIKE A ROBOT: but it is. Hitachi's Visual Image Processing Robot, for assembly and packing of objects on conveyor belts, can remember the form, position, size and orientation of an object which has been shown to its television "eye". It will thereafter recognise the object, even in disorder, and handle it with its servo arm as instructed. The arm shown is fitted with a vacuum suction device for picking up small objects.



Liquid crystal displays

While only a laboratory curiosity until just about two years ago, nematic liquid crystal readouts have the biggest potential for the display market of any device yet, by providing super-low power consumption, high-brightness viewing, and low cost. This article by Linden Harrison describes what liquid crystals are, the recent advances made, and the technologies included.

Liquid crystals are organic substances possessing many unique features, some of which had been realised over half a century ago, and others which have only recently been discovered. These substances belong to the "mesomorphic" state, the intermediate state between solid and liquid, and as such possess characteristics of both forms.

They pour like viscous liquid and assume the shape of their container. Yet, because of their highly ordered molecular structures over certain temperature ranges their optical behaviour is similar to that of the crystalline state.

Above this mesomorphic temperature range, they melt, becoming isotropic liquid, whilst below it they become crystalline solid. The mesomorphic temperature range may be only a few degrees, or may be as much as a hundred degrees wide. The transition from one state to another is reversible and accurately reproducible, the upper and lower threshold points being specific for each particular type of liquid crystal.

Approximately one out of every two hundred organic compounds is a liquid crystal, the common identifying feature being a flat rod-shaped molecular structure, and the form the structure takes determines the "mesophase" or class to which the compound belongs. There are three known classes of liquid crystal, these being smectic, cholesteric and nematic.

The term smectic is derived from the Greek meaning "soap-like", and as such the smectic structure resembles that found in certain soaps. It is a turbid and viscous state, the molecular structure being very orderly and well-defined, with molecules aligned in a common axis in neat rows within individual layers. Smectic substances are sometimes used in the field of chemical analysis, where this high degree of molecular alignment enables research materials under microscopic analysis to be temporarily aligned within their solution.

Cholesteric types are probably the best known, owing to extensive research having been devoted to them. The name is derived from cholesterol, of which certain derivatives are liquid crystals. This material is both turbid and mobile and in some ways the structure resembles that of both the smectic and nematic types. The molecular structure is arranged in thin parallel layers; however, in this case each successive layer is axially twisted, or rotated, out of alignment with its neighbouring layers, so that the net result is a helical structure.

The cholestoric structure is optically active, and possesses optical rotary powers up to about 70,000 rotations per millimetre. When the material is illuminated with white light, it scatters the light, giving rise to an iridescent colour which varies with the operating temperature. It also varies with the compound used and the angle of incident light.

However, because of this underlying sensitivity to temperature, it is now possible to obtain many different cholesteric compounds, collectively operating over several hundred degrees Celsius, which exhibit distinctive colour variations in certain narrow temperature bands.

The third type, the nematic mesophase is of special interest here, as under certain conditions it may be controlled electronically. The word nematic derives from the Greek, meaning "thread-like", and on a flat glass surface when viewed under X100 microscope with crossed polaroids, this apparently clear fluid is seen to contain long wavy threads.

In bulk solution the nematic material appears as a very pale yellow milky liquid. The molecular structure, however, is unique, as although the molecules seem to lie parallel throughout the medium they are in fact arranged in random oriented groups or "swarms". The long wavy threads referred to are boundaries or discontinuity lines between swarms. Any disturbance such as movement causes molecules to break away from their respective swarms thus decreasing the size of the swarms and increasing the number of boundaries between them.

Under turbulent conditions so many boundaries are created that any incident light is scattered throughout the medium and is reflected. To an observer, this appears diffuse. Alternatively, if the material is undisturbed it appears quite clear and any incident light will pass through it.

All that is needed, therefore, is a means of creating turbulence in the material and this may be achieved by simply applying a voltage through it.

Although this property of voltage-activation has been known for many years, it is only quite recently that the application of using nematic materials as display devices has arisen. Much of the progress in this field has been made by RCA scientists, who have carried out extensive research for several years into voltage-activated nematic materials. In 1968, they published first reports of some of their results, and as a basis to most of their work was what was referred to as the "dynamic scattering mode" (DSM), the property of a nematic material to scatter ambient light, and appear diffuse, when voltage is applied.

A model for many studies and demonstrations has been the "variable transparent window". This consists of a thin film of nematic material between .0005 and .002in thick, sandwiched between two sheets of conductive glass. The whole unit is connected via a switch to a voltage source.

The conductive glass is usually tin-oxide coated, although good results can also be obtained with gold-doped conductive glass. The two conductive sheets are separated by a thin non-contaminating plastic film such as Mylar or Teflon of the same thickness as the nematic film.

In the OFF state, the window appears to be quite transparent, although faintly tinted due to the inner conductive surfaces.

Model demonstrates liquid crystal display panel with no power applied, left, and with voltage applied at right. Numerical displays require about 10 to 50V to activate and draw less than 25uA per segment.

However, in the ON state, the window will become immediately opaque, reflecting any ambient light.

With a digital display cell, the rear surface is often made black, so as to be optically absorbent, and aid contrast. The digital 7-bar pattern is formed by etching away unwanted parts of one of the conductive surfaces and by cutting away parts of the plastic spacer film, so that when a voltage is applied, only the desired areas between the conductive surfaces are activated. The whole unit is then hermetically sealed to prevent contamination.

In the OFF state the digital display appears black, whilst in the ON state the numeral appears white against the contrasting background. Should the ambient light be increased, for example by going out of doors into strong sunlight, the display will appear brighter too, equivalent to several thousand foot-lamberts yet with the same power dissipation of less than 1mW per segment.

This feature is particularly attractive when one considers the relatively high power requirement of the Nixie tube, and LED. display, which in very bright ambient conditions appears washed out and virtually illegible, and any attempt to increase brightness will increase the power dissipation.

The mechanism by which DSM works is attributed to water present as an impurity within the nematic material, together with a flow of ions. The voltage level and the number of ions present will determine the amount of turbulence and this will cause the nematic to appear diffuse. Increasing the voltage in steps increases the optical contrast, thereby making it possible over a voltage range to plot a grey-scale. When the voltage is removed, the ions become stationary, and the nematic material becomes transparent again.

Of primary importance in using nematic liquid crystal material is the ambient temperature range to which it is likely to be subjected, both operating and storage. Until recently, only high-temperature nematics have been available in a temperature range of between 83° and 100°C. This type of temperature level is of no use to the display manufacturer, however. Now available from several chemical manufacturers are various "room-temperature" nematic materials that have operating ranges of between about 5° to 45°C, which are quite acceptable for most display applications.

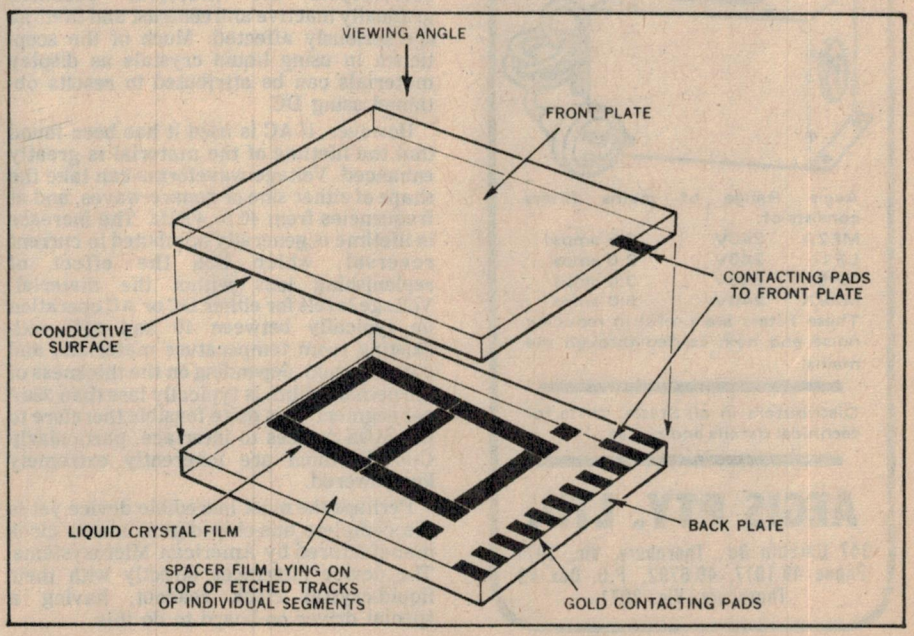
So far 7-segment displays are available in quantity from three US manufacturers, namely RCA, Optel Corporation, and American Microsystems Inc. General Electric hopes to be in volume production by 1973, and Texas Instruments is reported to have small quantities available for customer evaluation in the US.

RCA, from whom much of the present technology originated, now have several numeric displays on the market. These are available as either reflective or transmissive units, and available so far are two single-digit displays, two four-digit displays, and two other four-digit displays for use as digital clock readouts.

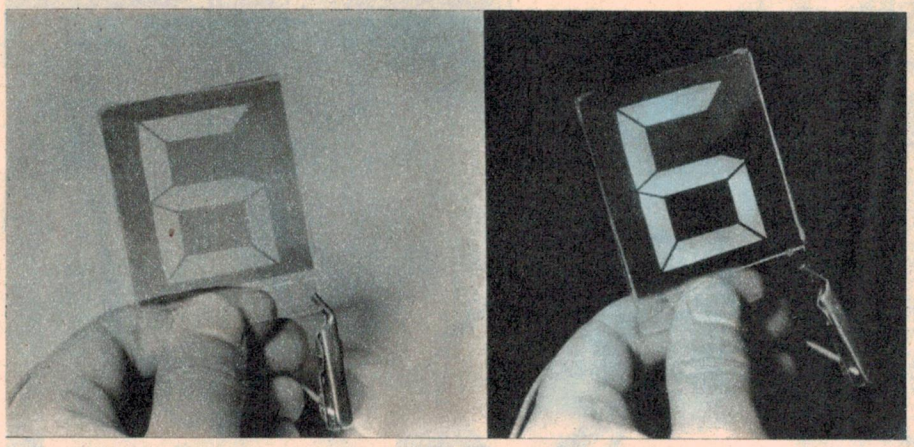
All these displays are individually addressed types and mount directly into standard 0.1in-pitch edge-connectors. Since July 1 last year, prices for RCA's liquid crystal displays have been drastically reduced, in some cases by up to 75%. This is due to improved manufacturing techniques, and clearly puts RCA into the lead. So much so that the 1000-off price for a single 0.75in-high liquid crystal digit (about $4.70 in the UK) is much less expensive than a ¼in-high GaAsP digit, and is almost directly the same price as that of the ⅛in-high GaAsP display. Clearly a remarkable achievement with such a new technology!

Optel Corporation of Princeton, New Jersey, the first company to introduce liquid crystal displays commercially, has three standard displays available. At the present time, Optel is concentrating its efforts in the digital wristwatch market, and is among the first pioneers on this area, with orders at present totalling over 10 million US dollars. Biggest customers at present are the Swiss watch manufacturers Avia, Omega, and Waltham Watch Co.

American Microsystems Inc of Santa Clara, Calif., have the largest range of devices available at the present time, and are said to be setting the pace by getting volume production up. AMI have already started taking business away from LED and display-tube manufacturers, because not



Typical construction details of one character of a liquid crystal display.



Experimental liquid crystal numeric display, made by Marconi, against light and dark backgrounds under identical lighting conditions.

only have they capability in liquid crystal displays, but they are reputed to be the world's largest source of standard MOS.

In contrast, Europe is a little behind in terms of mass-production of liquid crystal displays. In France, Thomson-CSF plans on launching several types by the end of this year, having already shown intended models at last year's Paris Components Show. So far several Continental auto manufacturers have shown interest in these displays, for use as speedometers.

So far, the UK has only one manufacturer of this type of display, Marconi Communication Systems (specialised component division). Research has been carried out for several years into liquid crystals by Marconi, and several types of readout have been developed, mainly for avionic and military purposes. Some types of display Marconi has developed are capable of a complete colour change, for example, green-to-blue, by totally electronic methods.

Another type possesses a memory function, which enables a unit to display information for up to several weeks after power is switched off. This type of display uses a combination of nematic and cholesteric liquid crystal, and can be instantly erased by the application of an AC signal in the kilohertz range. This concept could be extended to storage panels capable of reproducing high-density TV-type information.

In Japan there are a number of organisations researching and considering liquid crystal readouts. Among them are the giant corporations of Canon and Sharp, who, having suffered setbacks in calculator sales due to powerful competition from US calculator manufacturers, are now considering the much lower costs achieved by using liquid crystals.

Other companies such as the research division of Seiko Group, the Japanese watch manufacturer, and the Telegraph & Telephone Corporation of Japan, the leading telecommunications organisation, are engaged in very advanced research programs, which embrace applications as far apart as miniature wristwatch digits to holographic memories, and super-bright dot-matrix information displays.

It seems that the list is almost endless, and this is a result of the comparatively low costs involved in the manufacture of liquid crystal displays. All that is really required is a source of conductive glass, nematic material, spacer material, an etching facility, and you are in business!

A factor of considerable importance when operating liquid crystal displays is the type of "drive" voltage used. For it has been found that, while DC can activate nematic materials easily, due to ion-depletion and electrolysis the material becomes gradually inactive and contrast and lifetime are seriously affected. Much of the scepticism in using liquid crystals as display materials can be attributed to results obtained using DC.

However, if AC is used it has been found that the lifetime of the material is greatly enhanced. Voltage waveforms can take the shape of either sine or square-waves, and at frequencies from 40 to 400Hz. The increase in lifetime is generally attributed to current reversal, which has the effect of replenishing ions within the material. Voltage levels for either DC or AC operation lie typically between 10 and 50V with existing room temperature materials, and current drain, depending on the thickness of the nematic film, is typically less than 25uA per segment. It is quite feasible therefore to use MOS devices to interface, particularly C-MOS, which are inherently extremely low-powered.

Perhaps the most incredible device yet is the complete one-chip digital alarm clock manufactured by American Microsystems. The device interfaces directly with their liquid-crystal clock readout, having a special driver on-board to do this.

There are several other companies in a similar position, who produce MOS for their own liquid crystal readouts, and once the large majority of manufacturers realise that liquid crystal displays are here to stay, no doubt there will be numerous other sophisticated MOS devices available.

Whilst the efforts of present-day liquid crystal displays may not be seen fully for perhaps another 18 months yet, liquid crystals are a "now" technology. The only slight difficulty at present is that concerning the lifetime of the material, which is between 10,000 and 20,000 hours. Many manufacturers feel that this is inadequate, being only about one-tenth the lifetime of the LED type, or one-quarter that of the gas-discharge tube.

However, a considerable amount of research is at present being put into this factor, and, according to Optel's vice-president Edward Kornstein, this whole problem will be solved by next year. As well as which, new nematic materials are in development, which show from results so far that both lifetime and reliability can be increased further still.

It is expected by those most optimistic about this technology, that liquid crystal displays could be replaced much as are light bulbs. One Japanese manufacturer expects them to be made so cheaply that they will eventually be mass produced in long thin plastic strips, and when one display fails, another can be quickly inserted to replace it in a matter of moments.

Certainly, the first area to use this type of display will be the digital wristwatch market, which is forecast to produce somewhere in the region of 20 to 100 million digital watches per year within the next few years. Even so this is only one area that liquid crystals are likely to score, as RCA has already built prototype TV screens with them, with great success.

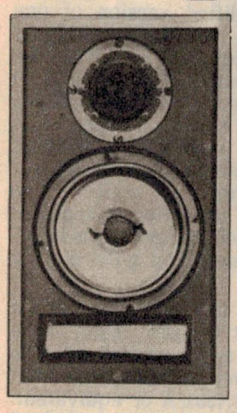
In any case, the price will by that time have dropped so much that it will subsidise other requirements for these displays, and will thereby become the lowest-cost display form on the market.

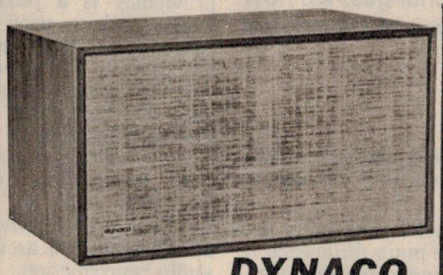
Already there are several "first-wave" products available, mainly in the USA, which utilise liquid crystal readouts. Apart from the several wristwatches, there are two makes of pocket calculator, an alarm clock, and electronic instruments with liquid crystal readouts.

Reprinted by arrangement with "Electron" magazine, London.

FOR THE AUDIO PERFECTIONISTS...

MORE HI-FI SYSTEMS TO CHOOSE FROM





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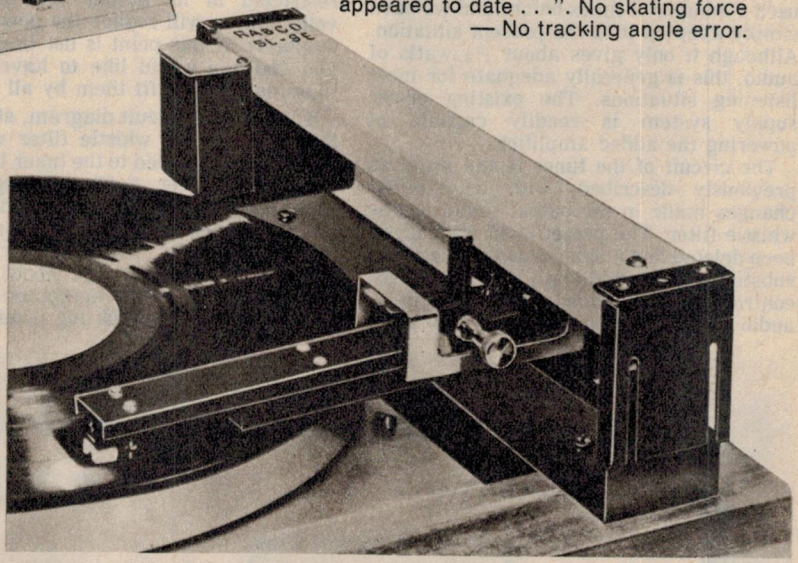

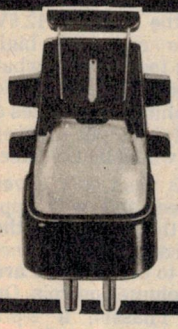

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High quality AM tuner-receiver

In December we described a broadcast tuner capable of high quality reception of local stations and in the narrow band position, stations from much further afield. By adding an audio amplifier and making a few minor changes, we now have a complete high quality receiver, still retaining the features of the original tuner.

by IAN POGSON

When the Playmaster 138 Tuner as described in December was being developed, we considered that it might be a good idea to extend the concept to a receiver, complete except for a loudspeaker. Coupled with a small loudspeaker enclosure, such a combination could be readily portable and may be carried from room to room as the need arose.

Many hi-fi enthusiasts already have a wide band tuner permanently installed and normally this provides reception of radio programs. However, there are often times when it would be more convenient to listen in some other room and rather than turn up the volume so that it may be heard at a distance, the concept of a second receiving system has some merit. As there was room in our new tuner to add a small high quality audio amplifier, we decided to add this facility.

The audio amplifier is one which we have used a number of times before and we have simply adapted it to the present situation. Although it only gives about $1\frac{1}{2}$ watts of audio, this is generally adequate for most listening situations. The existing power supply system is readily capable of powering the added amplifier.

The circuit of the tuner is the same as previously described, with only minor changes made in the output following the whistle filter. The preset level control has been deleted and a volume control has been substituted. In addition, a treble boost control has been added, together with an audio output facility so that the tuner section may still be used in conjunction with a tape recorder, hi-fi amplifier, etc, should the need arise.

Mechanically, the tuner and receiver are virtually the same. The main difference is that separate front panels are required. Some extra holes are needed in the metalwork for the receiver and they are simply left unused for the tuner.

As the tuner section has already been described in detail, we do not propose to repeat it and the former article should be read in conjunction with this one.

You will notice that a pair of dial lamps are shown in the circuit diagram but that we have not included them on the actual receiver. We have made the lamps optional on the receiver because they cause a slight voltage drop from the power supply available to the audio amplifier. As mentioned earlier, the audio amplifier is restricted in its output and this small voltage drop will reduce the power output available. If this point is not important to you and you would like to have the dial illuminated, then fit them by all means.

A look at the circuit diagram, starting at the output of the whistle filter will show what has been added to the tuner to make a complete receiver. A 47k isolating resistor feeds the output socket which enables the tuner to be used with external amplifiers, etc. A 1M linear potentiometer with a 100pF capacitor provides about 10dB of boost at 10kHz in the maximum position. Following this is a 500k log potentiometer for the volume control, feeding into the audio amplifier.

The audio amplifier as mentioned previously is a modified version of one which we have used before. Some circuit values have been adjusted to allow the amplifier to be operated at a nominal 20 volts. The 33 ohm biasing resistor in series with the OA91 diode has been selected to give a minimum of crossover distortion. The 1k resistor is also about optimum for the conditions under which the amplifier will be operating. Negative feedback over the whole system helps in DC stability as well as ensuring good quality audio reproduction.

The first stage of the amplifier uses a conventional NPN transistor, such as a BC108. Alternative types include BC208, AY1121, etc. The driver transistor is a PNP type BC178, TT608, 2N3638A or equivalent. The complementary symmetry output stage uses a TT801 or AY8139 for the NPN and a TT800 or AY9139 for the PNP. Do not attempt to use the output pair without heat sinks.

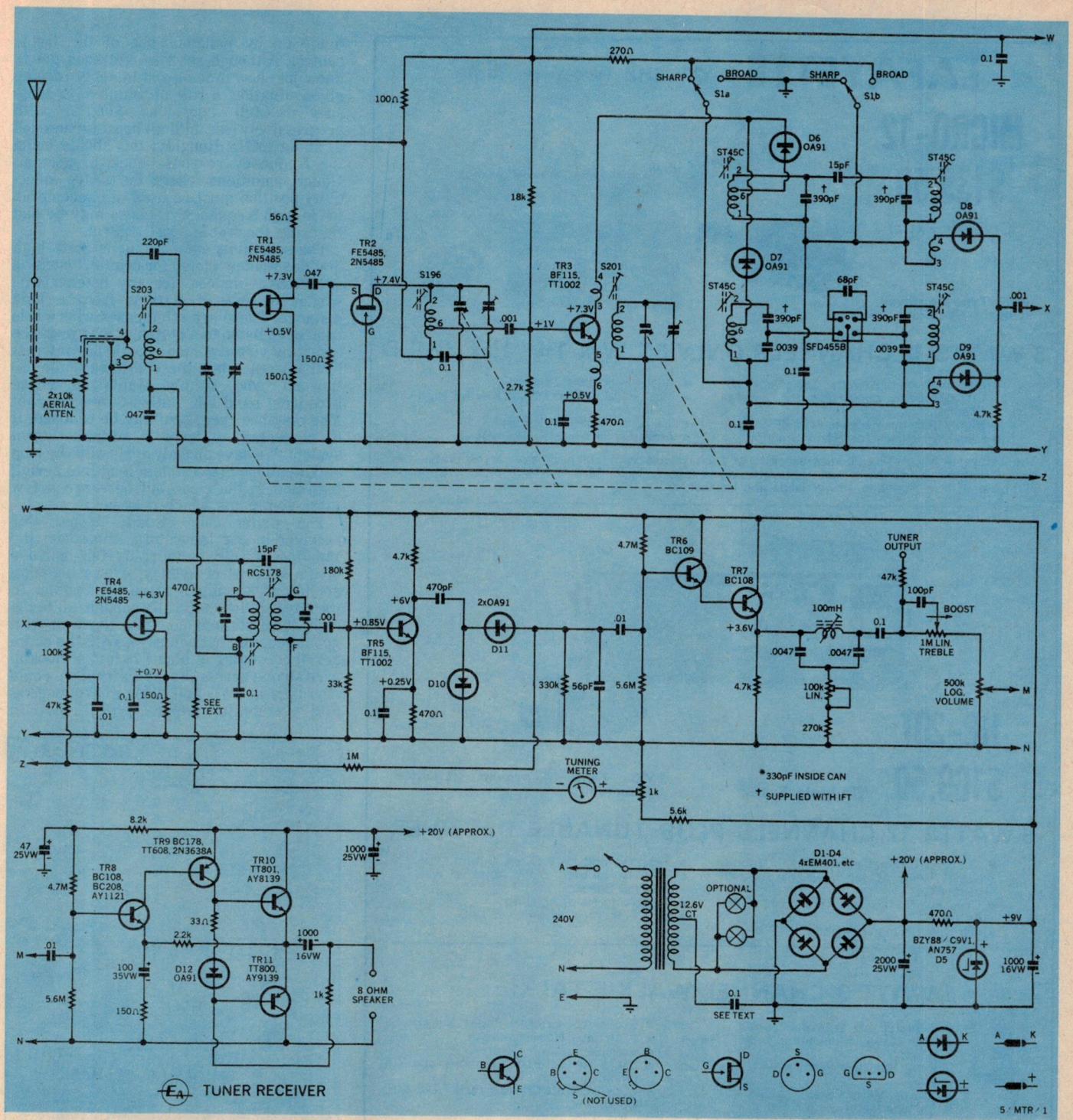
The board is made to accommodate single ended electrolytic capacitors, such as Elna or physically similar types. However, if single ended electrolytics are not readily available, then double-ended types stood on end may be used. Care must be taken at all times to ensure correct polarity.

The nominal 20 volts supply for the audio amplifier is derived from the positive end of the 2000uF electrolytic capacitor of the power supply. According to calculations, with a 12.6V AC supply at the secondary winding of the transformer, something of the order of 17.5 volts would be available as rectified DC. Due to design factors involving small power transformers, regulation is such that the nominal 12.6V under the loading here may even be as high as 14V. This is the reason for the somewhat higher supply voltage available to the audio amplifier. This is a good thing as it makes a somewhat higher audio output power available than otherwise would be the case.

Construction comments need only cover the extra items involved and will supplement those given in the article on the tuner. Assuming the alternative front panel is fitted, the extra items to be mounted are for the treble boost and volume controls. On the back skirt of the chassis, a 2-pin miniature speaker socket is mounted.

Assembly of the audio board is straightforward, with comments in the earlier article applying. Full details are shown in the wiring diagram. When completed, the board is mounted on the back

The unit may be used as a complete receiver by adding a speaker, or it may be used as a tuner feeding a hi-fi system.



The tuner part of the circuit is the same as before. The output level control has been replaced by a volume control and an audio amplifier has also been added.

skirt of the chassis with a pair of ¾in long brass spacers. To do this, it may be necessary to drill an extra hole in the board in the corner near the 1k resistor.

With all the items mounted, interwiring may be done. Leads from the audio board go to the speaker socket and the +20V supply, with a shielded lead to the volume control. Wiring between the volume control and the treble boost control may be done with ordinary hookup wire, provided leads are kept short. The 100pF capacitor is soldered directly to the lugs of the treble boost control and the 47k resistor may also be soldered to the same control. A piece of hookup wire is soldered to the other end of the resistor and the lead terminated at the outlet socket on the skirt of the chassis.

As mentioned before, the output trimpot level control has been dispensed with and a lead is taken to the treble boost control from the 0.1uF capacitor on the tuner board. An earth lead is also run from the copper on the board to the appropriate lug on the volume control.

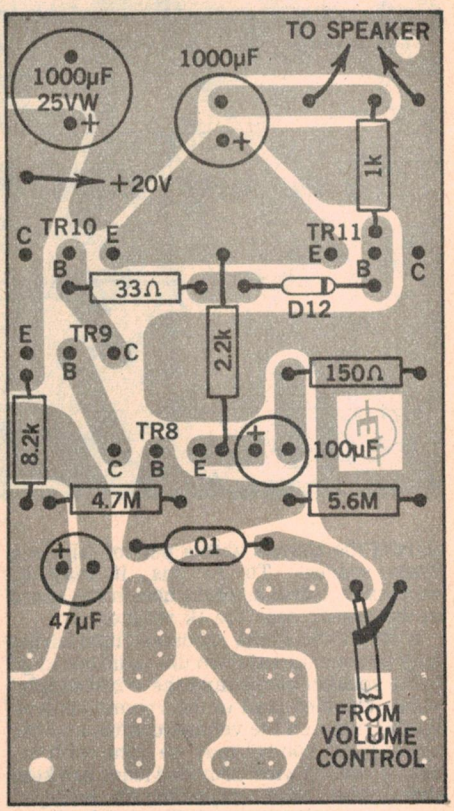
A careful scrutiny of the rear picture will reveal that when compared with the equivalent picture of the tuner, we have added an extra pulley for the dial cord on the dial scale mounting screw adjacent to the drive spindle. This was added to give an extra bit of coupling of dial cord to the drive spindle, which helps in giving a more positive drive. This addition is not essential and may be considered as optional.

Suggestions for tuning in stations have already been made in the earlier article and the same comments still apply. However, as the receiver does not normally feed into a separate control unit and audio amplifier, the loss of treble due to sideband cutting at the low frequency end of the band can be

made up by judicious use of the treble control. Although readers will soon get to know just how much boost to apply for any given situation, a rule of thumb as a guide suggests full boost at 530kHz, with progressively less until all boost is removed at about 1MHz. Roughly, this should bring the frequency response back to normal. Under conditions where the sharp selectivity position must be used, an acceptable lift in high frequency response may be had by using the treble boost control.

The sensitivity of this unit is quite high and this makes it ideal for country listening situations — indeed, for any listener who wishes to tune in stations from a long distance. There are often cases where it is desired to listen to a station a long distance away, by virtue of some particular interest in that area. Then there is always the enthusiast who simply wants to chase broadcast band DX stations. In order that long distance reception may be realised, it is necessary to have a suitable aerial system. We have already dealt with the loop and mentioned the random length of aerial, high and in the clear but here are a few more comments which may help.

The writer has already tested this receiver in our laboratory located on the 12th floor of a city building, as well as in one of the suburbs of Sydney, where listening conditions are much more favourable. In the city location, naturally enough, all of the eight local stations could be tuned in with good reception in each case. With the same aerial consisting of about 25 feet of hookup wire strung across the laboratory, we could also tune in 2WL and 2KA, in Wollongong and Katoomba, respectively. 2CR in



This coded diagram of the audio board makes assembly and wiring a simple matter. Care should be taken to observe transistor and electrolytic connections.

PARTS LIST FOR TUNER-RECEIVER

1 Chassis-panel, 9in long x 3½in high x 6in deep
1 Cabinet to suit
1 Dial assembly, RCS
4 Knobs
1 Tuning meter, S units
1 Toggle switch, SPDT
1 Toggle switch, DPDT
1 RCA phone socket
2 Terminals, 1-red, 1-black
1 Rubber grommet for power cord
1 ¼in extension shaft
6 Spacers, ½in long x ¼in diameter, tapped ⅛in Whitworth
6 Spacers, 1in long x ¼in diameter, tapped ⅛in Whitworth (see text)
1 Printed board, 9in x 3in, 72 / 11T
1 Printed board, 3⅝in x 2in, 71 / A8
1 Aerial coil, Aegis S203
1 RF coil, Aegis A196
1 Oscillator coil, Aegis S201
4 IF transformers, Aegis ST45C
1 IF transformer, RCS 178
1 Whistle filter assembly, RCS
1 Ceramic filter, Murata SFD455B
1 Power transformer, 12.6V 1A, PF1728, PT2150 or similar
1 Miniature tag board, 12prs tags
1 5-pin miniature tag strip
2 Dial lamps, 12V 1.5W, Lilliput Edison Screw
2 Sockets for dial lamps
2 Rubber grommets to fit lamp sockets
3 Transistors, FE5485, 2N5485
2 TT1002, BF115
1 BC109
2 BC108, BC208, AY1121
1 BC178, TT608, 2N3638A
1 TT801, AY8139 (with heat sink)
1 TT800, AY9139 (with heat sink)
7 Germanium diodes, OA91 etc
4 Silicon power diodes, EM401 etc
1 Zener diode, BZY88 / C9V1, AN757 or similar
1 2-pin miniature speaker socket

RESISTORS (½ watt)

1 33 ohms
1 56 ohms
1 100 ohms
4 150 ohms
1 270 ohms
4 470 ohms
1 1k
1 Trimpot 1k linear
1 2.2k
1 2.7k
3 4.7k
1 5.6k
1 8.2k
1 10k + 10k linear tandem pot
1 18k
1 33k
2 47k
1 100k
1 180k
1 270k
1 330k
1 500k log pot
1 1M
1 1M linear pot
2 4.7M
2 5.6M

CAPACITORS

2 15pF NPO ceramic
1 56pF 630V polystyrene
1 68pF 630V polystyrene
1 100pF 630V Polstyrene
1 3-gang padderless, 200pF-90pF-200pF, with trimmers, Roblan
1 220pf 630V polystyrene
1 470pF 630V polystyrene
3 .001uF 630V polystyrene
2 .0039uF 400V polyester
3 .01uF 100V polyester
1 .047uF 25V ceramic
1 .047uF 100V polyester
10 .01uF 100V polyester
1 47uF 25VW electrolytic
1 100uF 35VW electrolytic
2 1000uF 16VW electrolytic
1 1000uF 25VW electrolytic
1 2000uF 25VW electrolytic

MISCELLANEOUS

Hookup wire, solder, lugs, screws, nuts, cable clamp, 3-core flex, 3-pin plug, 1yd light coax cable, etc.

Note: Resistor wattage ratings and capacitor voltage ratings are those used with the prototype. Components with higher ratings may generally be used providing they are physically compatible. Components with lower ratings may also be used in some cases, providing the ratings are not exceeded.

Orange, could just be discerned amongst a roar of noise and was quite useless.

Next, we added the loop aerial with the balun. The difference was noticeable on local stations in that there was a useful reduction in noise. However the results were quite dramatic when it came to listening to some of the country stations. Compared with the straight aerial, where 2CR was quite useless to listen to, when a change was made to the loop 2CR came in "loud and clear". This is not to say that the noise was completely eliminated, but a reasonable guess would be that the noise was reduced by about 90pc. Although not so dramatic, very useful reductions in noise were obtained on some other country stations.

With the loop aerial, it was also possible to tune in some of the Newcastle stations in the city location. However, they were not of sufficient reception quality to be of real entertainment value.

Another interesting aerial system which some readers may find useful, is a standard ferrite rod aerial. This obviates the need for any wire aerial as such, but it must be tuned to the wanted station. Having made this provision, the rod should then be rotated so that it favours the station.

There is one point with respect to the ferrite rod aerial which hi-fi enthusiasts must not overlook. Due to the high Q of ferrite rod aerials, the added selectivity is such that significant sideband cutting is experienced, particularly at the low frequency of the band. Happily this disadvantage may be largely overcome by using the treble boost control.

In the suburban location previously referred to, results were much better than those obtained in the city. Not only were the locals received with virtually no noise at all but with the help of a loop, such stations as 2CR Orange, 2KA Katoomba, 2WL Wollongong, were received so well that they

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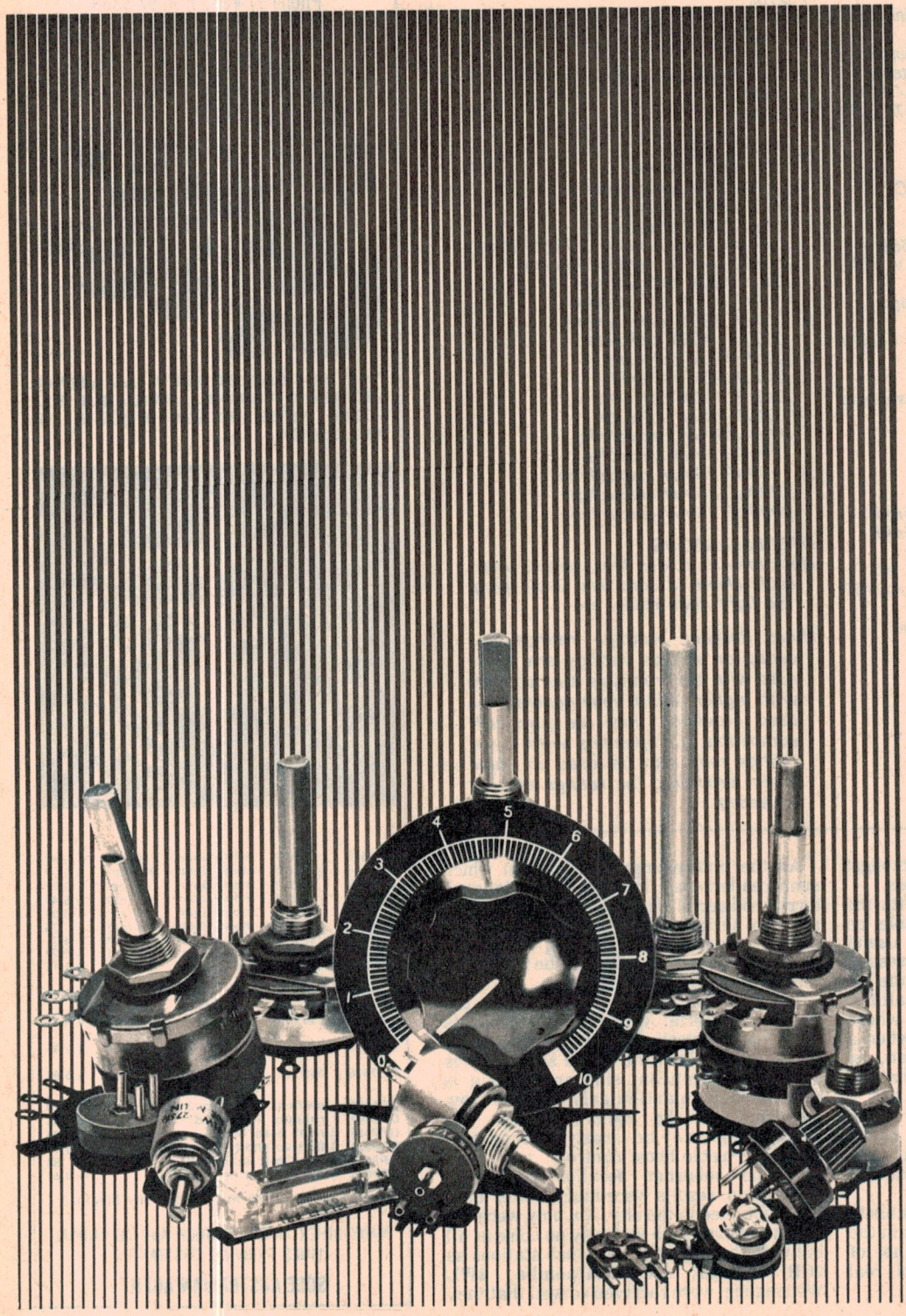

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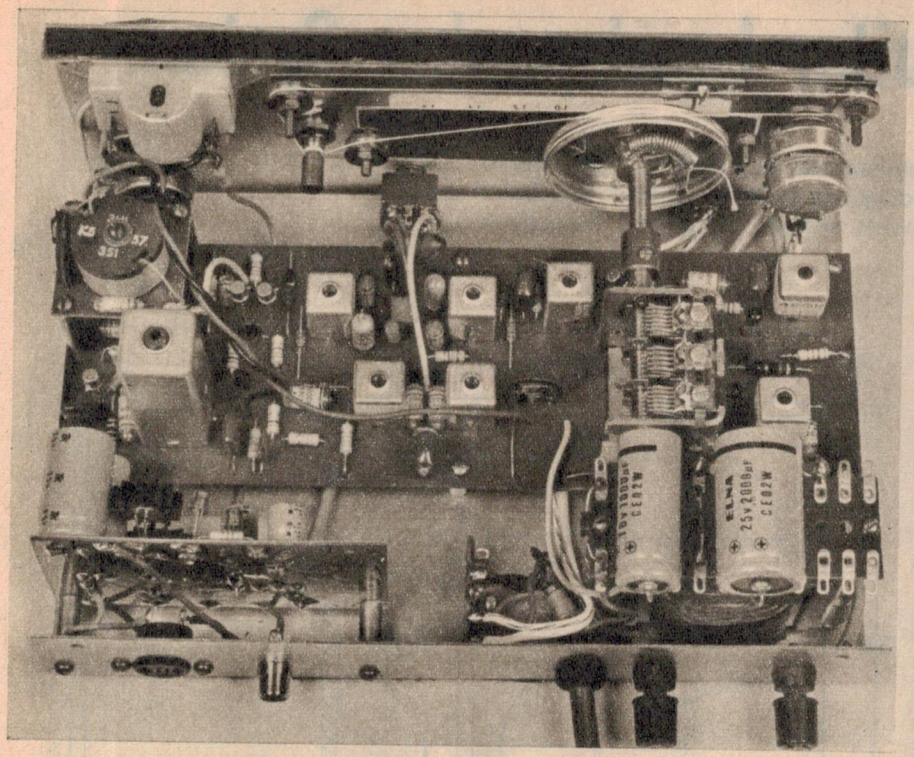
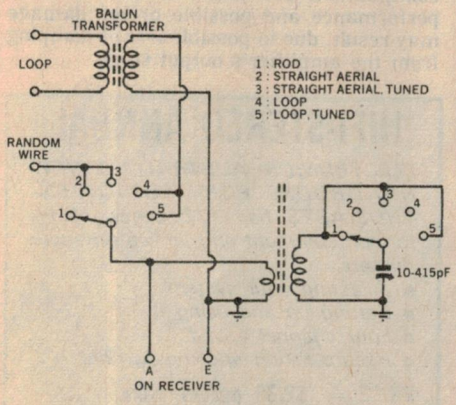


This inside view shows the location of all the major components. The dial stringing method may also be seen and may be studied along with the text. Note the extra pulley near the drive shaft and the 47k resistor on the treble control.

could be considered as of very good entertainment value. More distant stations, such as 2BS Bathurst, 2NU Tamworth and even 2CO Albury, just to mention some of them, were useful in varying degrees.

Newcastle stations were not as good as one might expect from the loop but this was due solely to the directional properties of the loop. With the loop in a more favourable direction, results could be quite different. However, with a straight wire aerial, the Newcastle stations were tuned in at useable strength. 2GO Gosford could be added to these. Although we have omitted to mention it thus far, we are referring to results during daylight hours. At night, every channel right across the dial is well occupied!

Readers who wish to pursue the hobby of chasing long distance stations would be well advised to experiment with different aerials. In fact, no one aerial will necessarily give best results for all stations and a number of aerials may be installed and switched as required. In a modest way, we have done this and the results have been very satisfying. Three aerial systems are available at the flick of a switch. They are, the ferrite rod alone, a straight length of wire and the loop.



This is the circuit of the aerial and switching system as described in the text. It may be adopted completely or in part as required.

It was found that improved results could be achieved, particularly where strong local stations were nearby, by a combination of the straight wire or loop and the tuned ferrite rod. These combinations reduced adjacent channel interference and helped in a better match between the aerial and receiver, again with improved performance. We have drawn the circuit of the arrangement, which provides for five different situations. These include the ferrite rod, straight wire untuned, straight wire tuned, loop untuned and the loop tuned. Any one may be selected to meet the immediate need. Obviously, for wide band listening, the best position is most likely to be the untuned loop.

This switching arrangement may be made up as an outboard accessory, with the 2-pole 5-position rotary switch, variable capacitor, terminals and rod mounted on a suitable metal or wooden case. The ferrite rod could even be so mounted that it may be rotated for best reception when used by itself (rotation is not necessary when the rod is used in combination with another aerial). Perhaps some readers will not be very interested in the foregoing comments on long distance reception, but they have been added for those who have an interest along these lines.

A New 30W Guitar Loudspeaker System

Using a newly released Magnavox 10in loudspeaker as a basis, it is possible to construct a range of highly functional loudspeaker systems for electric guitars. Possibly the most interesting is a 30-watt system using two Magnavox loudspeakers type 10W Mk IV.

by STUART BARTON

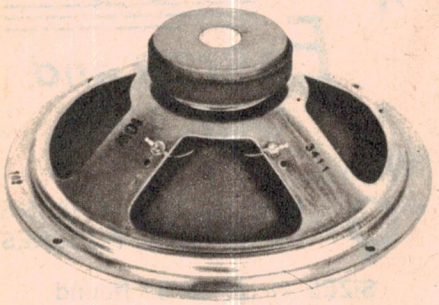
There is an application for a low power and inexpensive guitar loudspeaker system for use with practice amplifiers, by guitarists in jazz groups, or in situations where the guitarist does not feel a need to use a 500W-1kW amplifier to get his music across!

Such a loudspeaker system has been designed, using a pair of Magnavox 10W loudspeakers. The construction, performance and power handling of the 2.5 cu ft (72 litre) system are discussed.

The loudspeaker enclosure is made from ¾" pyneboard (or similar) as per the accompanying drawing.

The loudspeaker drivers must be mounted from the front of the enclosure, as the back panel is glued and pinned in place. This gives a lightweight, but very strong airtight box, obviating any necessity for internal bracing.

The box may be assembled on a cleat framework, should the home-constructor not have access to a router. A frame work is not necessary for strength, however. The baffle should be painted matte black, but the external surfaces can be veneered, painted or covered with vinyl according to taste.



The drivers are screwed in using 1in x No. 6 wood screws, after a loose filling of fibreglass has been placed inside the enclosure. The fibreglass is to deaden standing waves and improve bass performance by its isothermic properties. A low density type is recommended (eg. A.C.I. type SF 100) and 2 battes of 17" x 22" x 4" will suffice.

Grille cloth is tightly stapled on a braced ¾in x ¾in frame. This is attached to the recessed baffle using panel pins, or other suitable means, so that the frame may be removed should access be required to a loudspeaker. The grille cloth itself should be a fairly open weave plastic type, to introduce the least possible acoustic attenuation.

The loudspeaker drivers specified are two Magnavox type 10W Mk IV fitted with the Galex guitar cone. The impedance of the individual drivers should be twice the system impedance as the drivers must be connected in parallel.

The 10W driver is available normally in 3.5, 8 and 15 ohms; 33 and 47 ohms are also available at a slightly higher price. System impedances of approximately 2,4,8,15 and 24 ohms can therefore be arranged.

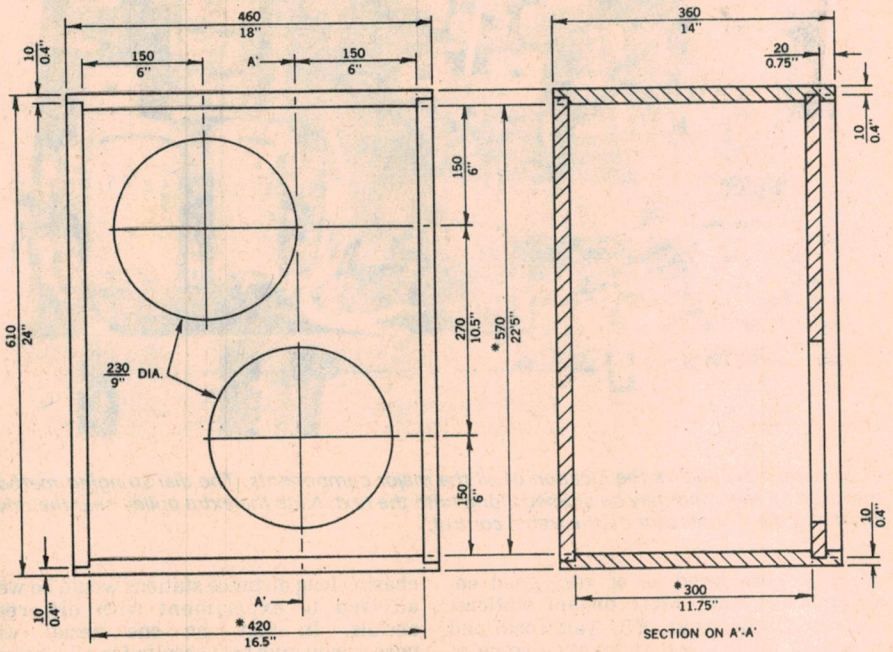
The frequency response of the system, as described, is 55Hz to 7kHz at the -3dB points. A pronounced response peak from 3kHz to 6kHz gives the rising response characteristic so desirable in guitar loudspeakers. Slight bass boost will increase low frequency response at around the 42.5Hz necessary for bass guitars, while a small amount of bass cut may be desirable for normal guitar use.

Each driver is capable of handling 20-watt RMS peaks without distortion due to cone breakup or bottoming of the cone suspensions in the 40Hz to 7kHz bandwidth. However the voice coil is not capable of more than 15 watts RMS continuous sinewave power, necessitating slight derating for an amplifier driven "flat-out", and further derating for an amplifier driven into clipping, or driven fully with a clipper or fuzz unit installed. Magnavox has therefore set a nominal power of 30 watts RMS on the loudspeaker system, as described.

Normally a 30 watt RMS amplifier could be used for straight guitar work. If, however, a "fuzz" unit or clipper is used, or the amplifier is continually clipped, a maximum of 20 watts RMS is advisable because the equivalent power will exceed 20 watts. On the other hand, a guitarist who does not use the amplifier at maximum output continuously (eg a jazz guitarist) may safely use a 40 watt RMS amplifier. Finally, a bass guitar would use a 30 watt RMS amplifier.

Should greater or less power handling be required, a box of 1.25 cu ft (36 litres) per driver could be constructed using details as above. Power handling would be 15 watts RMS nominal per driver and the driver impedance would be the system impedance multiplied by the number of drivers.

It is essential that multiple drivers be used in parallel. If series or series / parallel configuations are used, detrimental bass performance and possible driver damage may result, due to possible loss of damping from the amplifier's output stage.



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Building our new digital VOM project

Here is the second of two articles describing our new state-of-the-art digital volt-ohm meter. Following on from the circuit description given last month, it first gives construction details and then describes the calibration procedure.

by JAMIESON ROWE

Before dealing with the construction of the instrument, I should perhaps describe it again very briefly for the benefit of those readers who missed last month's article. It is a completely new design for a digital VOM, centred around an LSI integrated circuit recently released by Fairchild Semiconductor: the 3814. Readout is via low-cost LED (light emitting diode) displays—the FND70 devices, also by Fairchild.

The unit has an input resistance of greater than 10 megohms, ensuring low loading of the circuit under test. It has three voltage ranges for DC voltage measurement, and three for AC voltage, allowing measurement from a few millivolts to more than 1200V in each case. There are also three resistance ranges, covering resistance measurements from less than 0.1 ohm to 2 megohms.

With a $4\frac{1}{2}$-digit display, the unit provides a resolution down to 1mV for voltage and .01 ohms for resistance. When suitably calibrated it should provide an accuracy of better than 0.1pc of full scale reading under normal operating conditions.

Apart from the 3814 device and the four FND70s used for readout, the instrument uses nine other ICs, three FETs, three LEDs, 17 transistors, five zeners and 12 diodes. These components are all mounted on two printed wiring boards which fit neatly and easily inside a standard 195 x 130 x 105mm instrument case.

The foregoing is a very brief description of the new instrument, and obviously gives no insight into its operation. Those who intend building the unit are therefore advised to obtain and read the first article, which, besides giving a complete description of its circuit operation, also gives the parts list.

Cost of the unit at the time of writing should be less than $130, which is considerably less than for equivalent commercial instruments. At least part of the credit for this attractive price must go to Fairchild Australia Pty Ltd, who, as mentioned last month, are making another of their special semiconductor supply offers. This time the offer is being made via all of the accredited Fairchild distributors throughout Australia and New Zealand.

If you enclose the coupon from this article with your order, you will be able to buy the complete kit of all 54 semiconductor devices used in the project from Fairchild Australia's distributors listed below for the special low price of $80, including packing, postage and sales tax if applicable. The kit will come complete with data sheets, and at the price concerned represents very good value — the devices would normally cost in excess of $100, before postage.

Fairchild distributors who will have the kit available are as follows, with their local telephone number shown in brackets: In Melbourne, Warburton Franki (69 0151) and Radio Parts (329 7888;) in Sydney, Warburton Franki (648 1711) and George Brown (519 5855); in Adelaide, Gerard and Goodman (23 2222); in Perth, Warburton Franki (61 8688); in Brisbane, Douglas Electronics (97 8222); in Canberra, Electronic Components (95 6811).

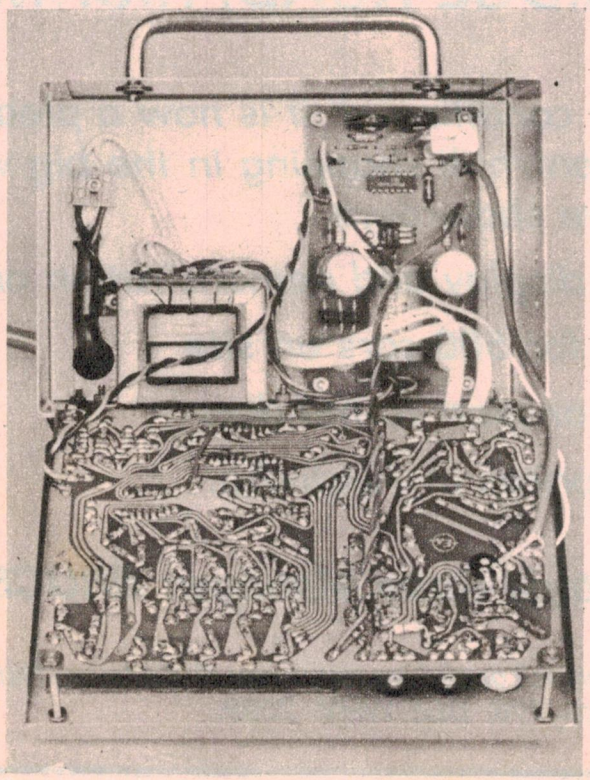
The offer also extends to readers in New Zealand, who should send the coupon to Fairchild New Zealand (Limited), at 1 Gordon Road, Otahuhu; or to John Gilbert, Anzac Avenue, Auckland; Tisco N.Z. Ltd at PO Box 102, Wellington; PO Box 823, Hastings; PO Box 1145, Hamilton; PO Box 2006, Dunedin; PO Box 1712, Christchurch; and PO Box 1355, Palmerston North.

Please note that Fairchild distributors in Australia and New Zealand will only be able to supply kits at the special offer prices when the orders are made via the order coupon printed in this article. Neither Fairchild nor their distributors can undertake to enter into any technical correspondence regarding the kits. The kits will not be available from "Electronics Australia" offices.

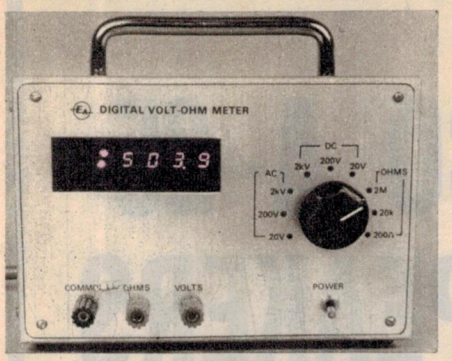
As noted earlier, the wiring of the instrument is on two printed boards. These should ideally be of the epoxy-fibreglass type, to ensure reliable operation of the high impedance analog circuitry.

Most of the circuitry of the unit is on the larger of the two boards, which measures 180 x 120mm. The board is fastened to the rear of the front panel, and parallel to it by means of four $\frac{1}{8}$in Whitworth screws $1\frac{1}{2}$in long. The screws are fitted with multiple nuts to space the board back from the panel by approximately $1\frac{3}{8}$in.

All of the components for the basic DVM section of the instrument are mounted on this main board, together with those for the input buffer, attenuator and resistance ranges current source. Even the LED readouts are mounted on the board, to simplify construction. Together with the single LEDs used for over-range "1" display and over flow indication, they are mounted in the top left-hand quadrant of the board as viewed from the component side. When the board is attached to the front



Inside view of the new DVOM, showing the front panel and main board tilted outward for servicing. Note that the main board shown here is an early prototype, not that shown in the wiring diagram, and is slightly different. As may be seen, the unit is easy to put together.



panel they become visible through the display window.

The digit selector transistors are mounted on the board above the readouts, while the segment drivers and virtually all of the digital circuitry of the instrument are mounted below them. Immediately below the readouts are the segment driver transistors and current limiting resistors, with the 9307 decoder IC and the 9602 clock generator below these. Finally, at the very bottom of the board are the two 9002 (or 7400) quad gates and the 3814 LSI device.

Although all of the other ICs in the instrument may be soldered directly into the board, I strongly recommend that you use a socket for the 3814 device. It is fitted with diode protection on the inputs and outputs, but in view of its relatively high cost — about $25 — one would be unwise to risk damage due to earth leakage in the soldering iron. With a socket, the 3814 may be left safely in its conductive plastic transport pack until the rest of the circuit is wired up, and then carefully plugged in.

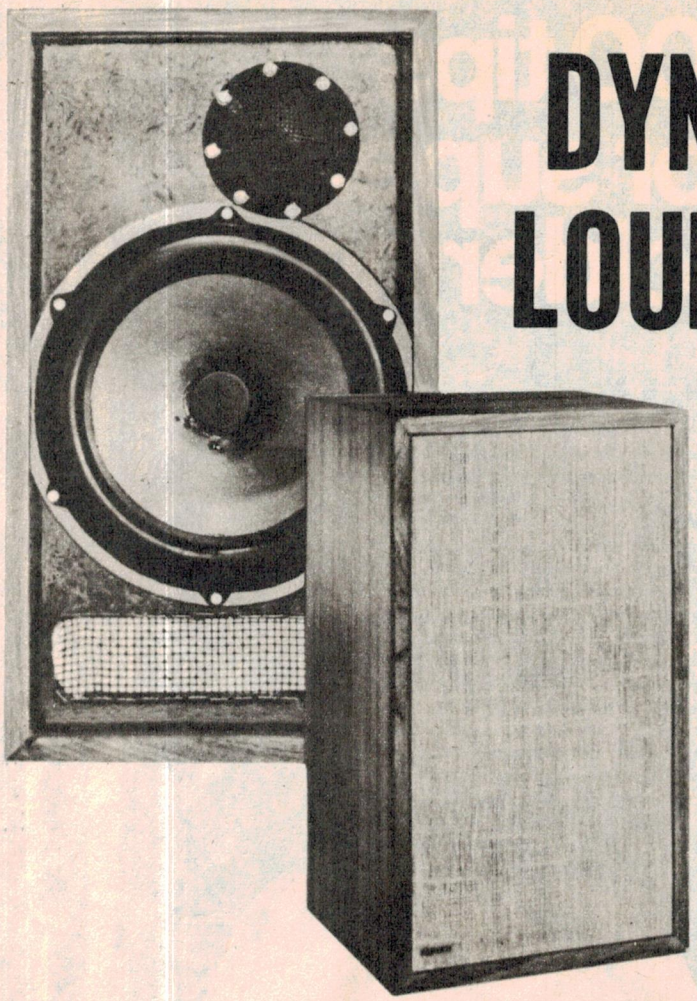
There are at least two 24-pin sockets available which are suitable for the job. One is the type 2150-24-02 marketed by McMurdo Australia (shown in the parts list wrongly last month as type 2150-29-02) while the other is the Robinson-Nugent type ICN-246-S2 from General Electronics Services. Either of these would be quite suitable.

A space has been left at the centre of the right-hand end of the main board, to allow clearance for the function switch. Above this space on the board are the input attenuator and buffer components, the resistance ranges current source and the integrator and comparator. Below the space are the reference current source, the FET switches for the integrator inputs, and the switch driver stages.

The second and smaller printed board measures 120 x 70mm and is used for the power supply wiring and the precision rectifier circuit used for the AC ranges. The 7805 voltage regulator IC is mounted a little above the centre of the board, with the other power supply components below it and the 741 op amp and its associated components at the top.

On both printed boards the preset pots used for zero setting and range calibration are mounted at the edges of the board to allow convenient adjustment by screwdriver via small holes in the assembled case. The only exception to this is the 10k control used for null adjustment of the 740 input buffer op amp, which mounts parallel to the board on the copper side. Once set, initially, this control should never need further adjustment.

The power transformer mounts on the bottom of the case, near the rear and to the



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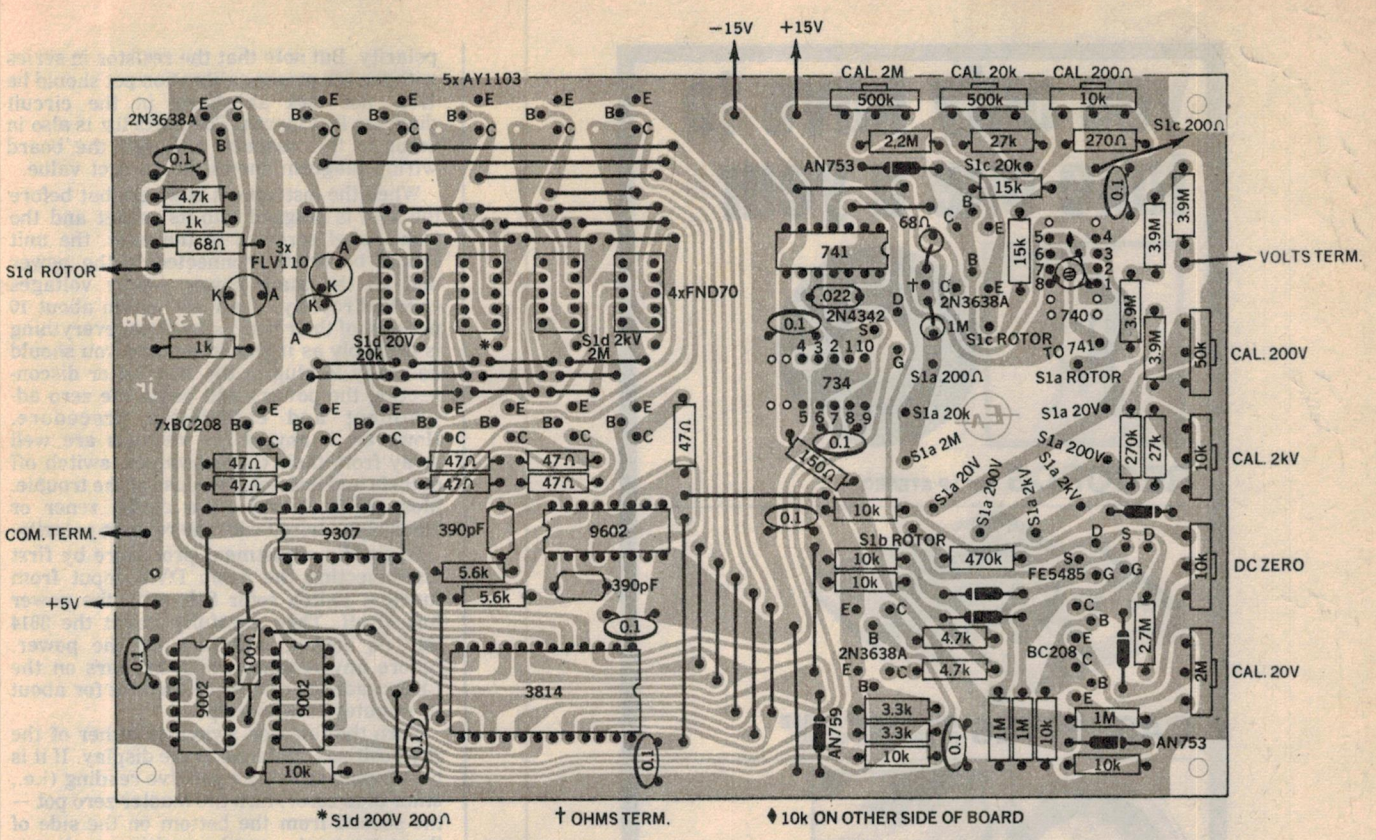
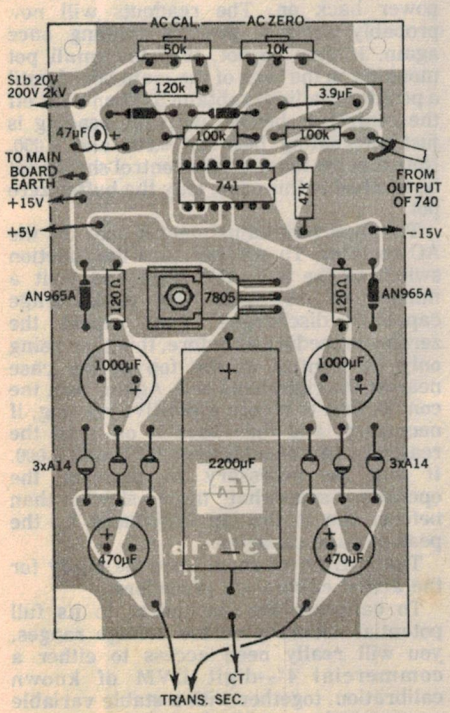


Wiring diagram for the main board, viewed from the component side.

left of the smaller wiring board. This may be seen in the interior photograph, where the mains cord may also be seen entering the case at the lower left-hand corner. The cord is clamped after entry, and the active leads terminated in the approved manner in a small "B-B" block. The earth lead is soldered to a lug mounted underneath the cable clamp screw.

The wiring of both printed boards should be fairly straightforward if the diagrams and photographs are used as a guide. Note



Wiring diagram for the smaller board, again viewed from the component side.

that there are a number of wire links used on the main board, particularly near the readout devices. These should be wired in quite light gauge tinned copper wire (say 26 or 28G) for convenience, and only insulated where this seems to be desirable to prevent shorts.

The main thing to bear in mind when wiring up the boards is to use great care and a minimum of heat and solder when making the joints. Of necessity, the pad sizes on the copper pattern and their spacings are small, and this increases the risk of both board damage and accidental shorts due to solder "bridges." A small magnifying glass can be an asset, particularly if one does inadvertently run solder between two adjacent pads.

Note that the wiring pattern on the main board implies the use of 14-pin DIL devices in the 740 and 734 IC positions, whereas both these devices are currently only available from Fairchild in TO-99 type round metal can format. This has been done to allow the use of 14-pin DIL devices if these later become available.

I suggest that you wire the main board and the function switch together as a single assembly before mounting either to the front panel of the case. The easiest approach is to first solder short lengths of tinned copper wire to the rear lugs of the rearmost switch wafer, then line these wires up with the corresponding inner circle of holes in the board, push them through until the switch is resting on the component side of the board, and then solder. The board and switch will then be held together to allow the remaining connections to be made.

It is a good idea to insulate the remaining wires connecting the function switch to the board in black sleeving, so that they will not be obvious through the display window when the instrument is assembled. Either varnished cambric "spaghetti" or nylex would be suitable. This applies especially to the wires associated with S1d and the decimal point display, as these wires pass quite close to the LED readouts.

Before mounting the main board on the front panel, a small piece of red or orange tinted perspex should be cemented to the rear of the panel over the display window opening. This serves the dual purpose of improving the readability of the LED displays, and disguising the surrounding printed board and components.

Care should be taken with the wire connecting the "volts" input terminal on the front panel to the board, to dress it well away from the mains switch. This is necessary to ensure low hum pickup, which could produce spurious readings on the lowest AC range. The wire should not be shielded, however, as this would tend to increase the input capacitance of the instrument rather drastically.

Basically, the only wire which should be shielded is that connecting the output of the input buffer stage to the AC range rectifier input on the smaller board. This lead should be run in light shielded microphone cable, with the braid connected to the earthing copper of both boards.

The wiring of the small board itself is quite straightforward. The main thing to watch is that the various diodes and electrolytics are wired in with the correct

polarity. But note that the resistor in series with the 50k preset calibration pot should be 120k, not 180k as shown in the circuit diagram last month. The parts list is also in error in this respect, although the board wiring diagram shows the correct value.

When the instrument is wired, but before the 3814 is plugged into its socket and the front panel screwed to the case, the unit should be briefly connected to the power and all the main power supply voltages checked rapidly. If all are within about 10 per cent of their nominal values, everything is probably as it should be, and you should be ready to plug in the 3814 (after disconnecting the power) and begin the zero adjustment and calibration procedure. However, if any of the voltages are well away from their correct values, switch off quickly and look for the cause of the trouble. Most likely it will be a diode, zener or electrolytic wired with the reverse polarity.

Begin the adjustment procedure by first disconnecting the basic DVM input from function switch rotor S1b, with the power turned off. Then carefully insert the 3814 into its socket, and turn on the power. Ignore any reading which appears on the LED readouts, and leave the unit for about 10 minutes to warm up.

Turn the function switch to either of the 20V positions, and look at the display. If it is not already showing a positive reading (i.e., other than zero), turn the master zero pot — the second from the bottom on the side of the instrument — until a positive reading is obtained. Then slowly back off the control until the reading displayed is just alternating between 0.001 and 0.000. This is the correct position for the control, even though turning it further back will produce an apparently more stable zero reading.

Having set the main zero adjustment, the input buffer zero should now be adjusted. To do this, first turn off the power, then reconnect the input of the basic DVM section to the rotor of S1b. With the function switch turned to the 20V DC range, turn the power back on. The readouts will now probably show a positive reading once again. If they do not, turn the small pot mounted on the back of the main board until a positive reading is obtained. Then back off the control as before, until the reading is just alternating between 0.001 and 0.000. Note that the master zero control should not be touched in this case, only the buffer zero pot.

The final zero adjustment is that for the AC rectifier. To set this, turn the function switch to the 20V AC range and wait a minute or so until the peak-storage capacitor discharges. Then repeat the zeroing procedure as before, this time using only the control at the top of the case nearest the right-hand end. Again, turn the control first to obtain a positive reading, if necessary, and then back it off until the reading alternates between 0.001 and 0.000. It will be necessary to perform the operation somewhat more slowly than before, due to the lag introduced by the peak-storage capacitor.

The instrument should now be ready for the actual calibration procedure.

To calibrate the instrument to its full potential accuracy on the voltage ranges, you will really need access to either a commercial 4½-digit DVM of known calibration, together with a stable variable power supply, or a precision voltage source

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ACT: Electronic Components Pty Ltd, 3 Pirie St, Fyshwick.
(For NZ distributors see text, on page 32.)

of similar accuracy. Hopefully, at least some readers will be able to arrange to borrow or gain access to such instruments, either from their employer or from the local technical college.

An alternative approach would be to use a voltage-measuring potentiometer, of the type often found in high school science labs. Used in conjunction with a stable variable power supply, this too would allow reasonable calibration of at least the two lower DC voltage ranges.

Whichever type of instrument is used, the ranges must be calibrated in a definite order to prevent interaction. The DC voltage ranges must be calibrated before either the AC voltage or resistance ranges, and the 20V DC range must be calibrated first of all.

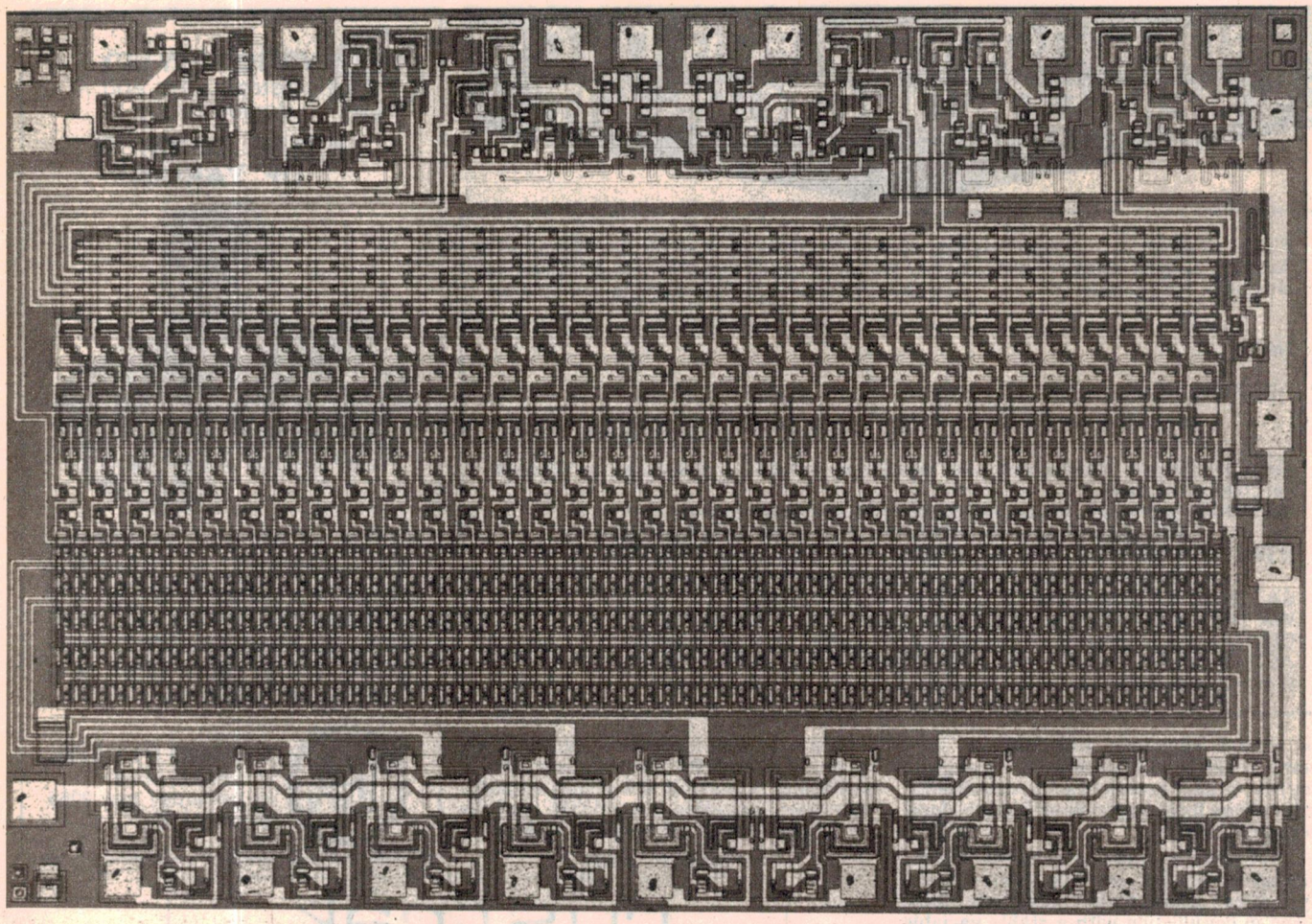
In each case, the calibration should preferably be performed at a level near full scale for the range concerned, to ensure highest accuracy.

Calibrate the 20V DC range at a level of around 18-19V if at all possible. Do this with the function switch in the 20V DC position, by adjusting the lowest preset pot on the right-hand side of the case until its reading coincides with that of the reference instrument. Then repeat the process for the 200V DC range, at a level of say 180V, but this time use only the uppermost pot on the right-hand side of the case. Finally, calibrate the 2kV range, at a level of around 1000-1200V, using the preset pot second from the top on the right-hand side.

Note that the preset pot used to calibrate the 20V DC range must not be touched when adjusting any of the other ranges. This control is actually the master calibrate control of the instrument — which is why it must be adjusted before any of the others.

After calibration of the DC voltage ranges, the AC ranges may be calibrated. This requires only a single operation, as the input attenuator range ratios have already been set by the DC range calibration. The easiest approach is to use a signal of between 10V and 20V RMS at 1kHz or so from a stable and reasonably low distortion audio generator, adjusting the DVOM until its reading on the 20V AC range coincides with

(Continued on page 57)



New Motorola PROM: "just that bit better"

Read-Only Memory devices or ROMs have now become fairly familiar to those working with digital ICs, but the newer programmable-ROMs or "PROMs" are less widely known. This article explains how the devices work, and also describes an interesting new PROM from Motorola Semiconductors which is aptly described as being "just that bit better".

by JOHN LINFORD

Section Manager, Bipolar Memory Design, Motorola Semiconductor Products Inc.

Read-Only Memories or ROMs are basically the IC (integrated circuit) equivalent of the traditional "wired program" patch panel. Unlike memory devices such as the magnetic core memory, magnetic tape or the random-access semiconductor memory (RAM), they cannot generally be used for continuous write-in / read-out of information. Rather they are intended as a compact and convenient form of storage for information which, once fed into the device, is only required to be read out.

There are many applications for this type of storage. An example is storage of the read-in or loader routine for a digital computer, the small "bootstrap" program which tells the machine how to accept other programs and store them in its main memory. As the loader is fixed for a particular machine, it is convenient to have it stored in a ROM and simply read out whenever it is required.

A further application is conversion of numbers from one digital code to another, such as pure binary to BCD or BCD to decimal. Here the numbers in the source code are used to address locations in the ROM, which is programmed to supply the appropriate equivalents in the new code. Another application is in character generators, where the pulse combinations required to generate alpha-numeric characters on say, a CRT screen can be read out in response to the corresponding code numbers.

More recently ROMs have found extensive use in the instruction decoding circuitry of digital computers, implementing a technique known as "microprogramming". In place of the hard wiring formerly used to set up logic gating in response to each instruction, a ROM is used instead; this allows the instruction repertoire to be changed or extended at any time merely by replacing the ROM with another having a different set of microinstructions.

A major reason for the increasing usage of semiconductor ROMs is the availablility of more complex devices at lower prices. As

This article is adapted from "Motorola Monitor", by courtesy Motorola Semiconductor Products Division, Motorola Australia Pty Ltd.

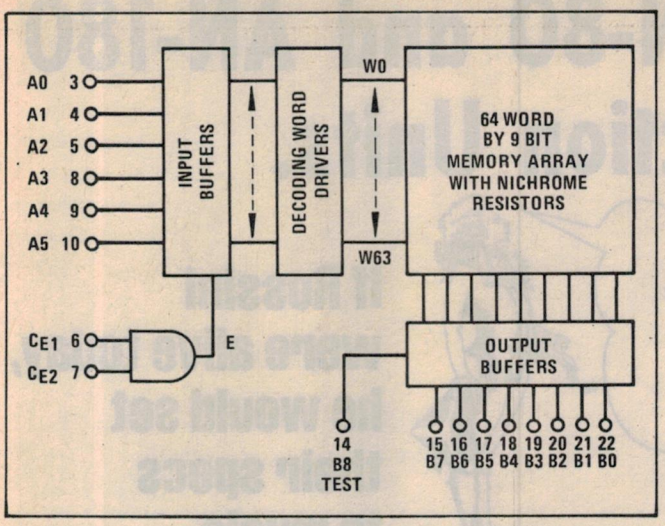
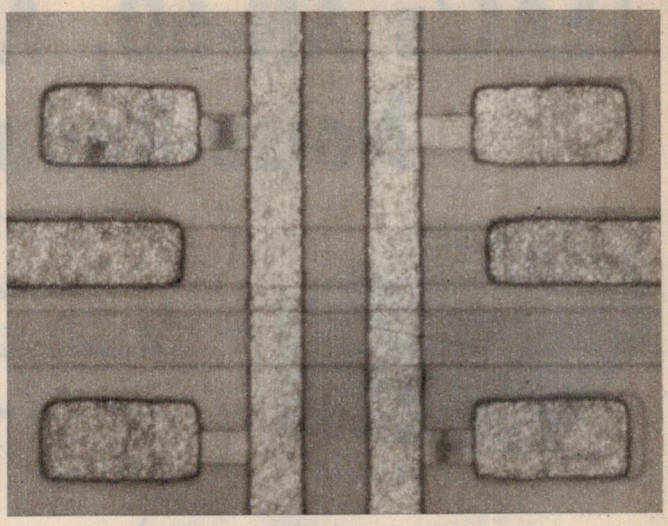


Fig.1 (above): Block diagram of the new Motorola 512-bit PROM. Before programming, all active output bits are in the logic O state, as all of the nichrome wire links between the decoder drivers and buffers are intact.



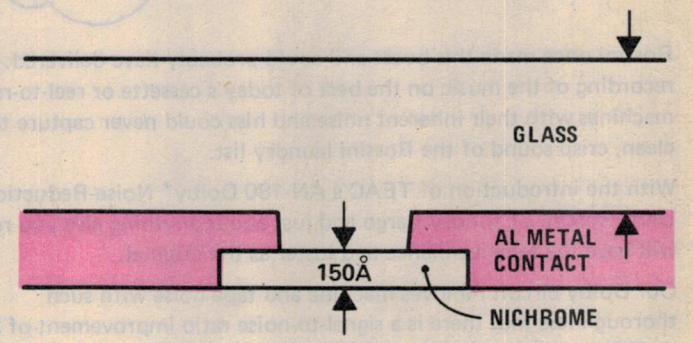


Fig.3 (right): At top is a close-up of the nichrome resistor array, showing two fused and two intact resistor links. At right is profile of the nichrome-aluminium-glass layers used in the PROM.

late as 1965, only 4 to 8 bits (binary digits) of information could be stored on a semiconductor chip. But advances in both MOS and bipolar technologies have now provided complex structures with as many as 1024 bits per chip on a current off-the-shelf basis, and up to 8192 bits per chip as the latest state-of-the-art capability. Such devices at last give the computer system designer the large, fast semiconductor ROMs needed for microprogramming and similar applications.

The first semiconductor ROMs were pre-programmed — ie, fabricated by the manufacturer as custom devices with configurations which corresponded to the program required by the customer. However this approach involved costly mask changes each time a new program was required, and each new device tended to involve a turn-around time of from four to eight weeks.

With expanding ROM usage has come the need for greater versatility in programmability, in less time. The field programmable read only memory or PROM has stepped in to fill that need. The ability to program a ROM at the customer's premises not only eliminates possible expensive mask changes, but has also done away with the turn-around time required to obtain a new ROM program. Now, turn-around time for special application ROMs has been reduced, literally, to minutes. This provides increased flexibility in making product design changes and modifications.

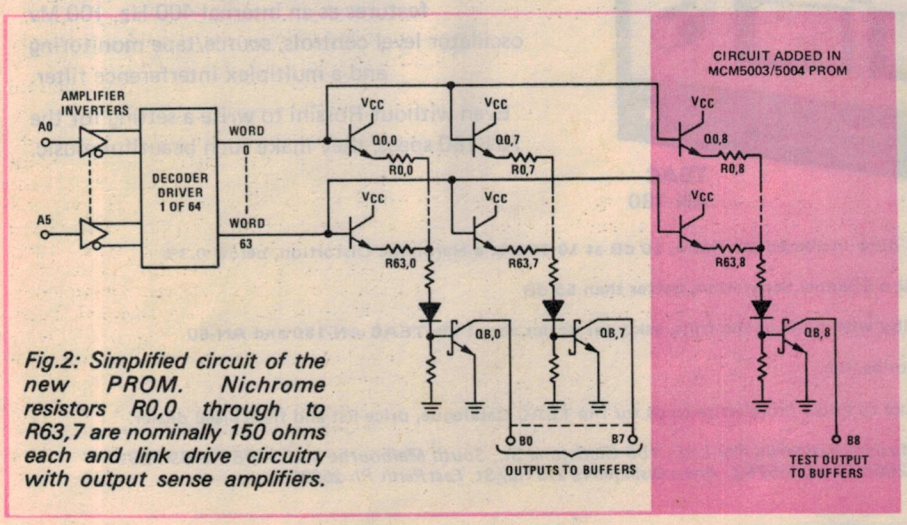


Fig.2: Simplified circuit of the new PROM. Nichrome resistors R0,0 through to R63,7 are nominally 150 ohms each and link drive circuitry with output sense amplifiers.

Programmable ROMs also affect the spare parts stocking situation. Keeping on hand many different ROMs that might be needed in the development of a computer system could be a formidable problem. Using programmable ROMs eases the situation considerably. A single device type and a programmer are all that are needed for many different custom ROM applications.

True, field programming of a ROM wasn't meant to compete with vendor ROM production on large quantity runs. Some circuits such as code converters, character generators, look-up tables, keyboard encoders, and some microprograms are off-the-shelf items at relatively low cost. But for special custom program applications, versatility makes the PROM a valuable tool in system design.

Both bipolar and MOS technologies are used to manufacture PROMs. The bipolar approach used in the PROM shown in the picture provides both a high-speed access time of 75 ns, and a new concept in flexibility. This device, the Motorola MCM5003 / MCM5004 512-bit PROM, adds a bit extra to conventional field programmable memory design.

The MCM5003 / MCM5004 (64 x 8 bit) programmable read only memory is a bipolar device with nichrome resistors as fusible links in a memory array. The nichrome resistor links are between the decoding word drivers and output buffers (see Figure 1). The PROM is manufactured with all fusible-link resistors intact, representing the logic 0 state for all cells. To obtain a logic 1 output for a particular cell, it is necessary to open its corresponding nichrome resistor element.

The following functional description of the

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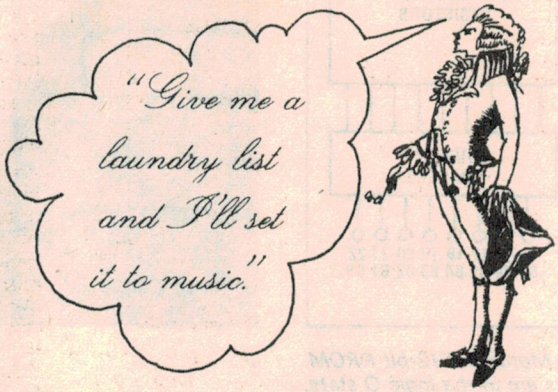

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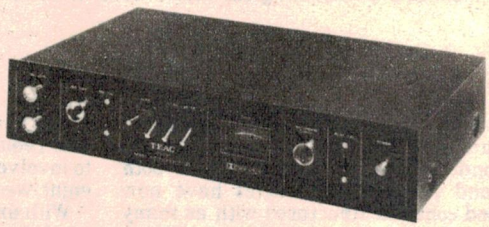

It's actually a simultaneous record-playback control center with its own record and playback amps. It has built-in mike and line preamps that maintain mixing capability, or add this capability to recorders not so endowed.

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AMI 143 / R

PROM refers to Fig. 1. Six address lines (A0 through A5) are used to select 1 of 64 binary coded words. The memory array consists of 64 words by 9 bits, although the customer normally uses only 8 of the 9 bits available in each word. The 8-bit words appear on outputs B0 through B7.

The PROM has two chip enables (CE1 and CE2) which are ANDed together internally. Both chip enables must be high to enable the selection of one of the 64 words (W0 through W63) in the memory array. The MCM5003 has open collector outputs while the MCM5004 has 2 kilohm pull-up resistors on the outputs.

As seen in Fig. 2, a typical memory array consists of nichrome resistors R0,0 through R63,7. (Circuitry in the shaded area of Fig. 2 is a ninth bit that has been added for testing purposes, and will be discussed later.) Each nichrome resistor has a nominal value of 150 ohms. Vacuum deposition techniques are used to deposit these thin film nichrome resistors on the planar surface of the device chip, to ensure uniform thickness (see Fig. 3).

The MCM5003 / MCM5004 PROM provides additional programming circuitry to make certain that enough current gain is available to open, or blow, memory links. To program a logic 1 into a memory location, at R0,0 for example, the proper bit output line, B0 in this case, is connected to —6.0 volts. This causes the associated transistor in the program circuitry to turn on, allowing fuse current to flow through the nichrome resistor R0,0.

It takes 25 to 35 mA of current to open a nichrome link. During this programming time the sense amplifier circuitry is turned off. The circuit technique described above results in a high ratio of programming current to operating current in order to ensure that the nichrome resistor does not program accidentally during normal operation.

One major problem faces the engineer when he receives an unprogrammed PROM. That is how can he test the device before he inserts his program? How can the new PROM be tested for programmability? How can read-out time to an actual address be tested? It turns out, that for most available PROMs, this can't be done.

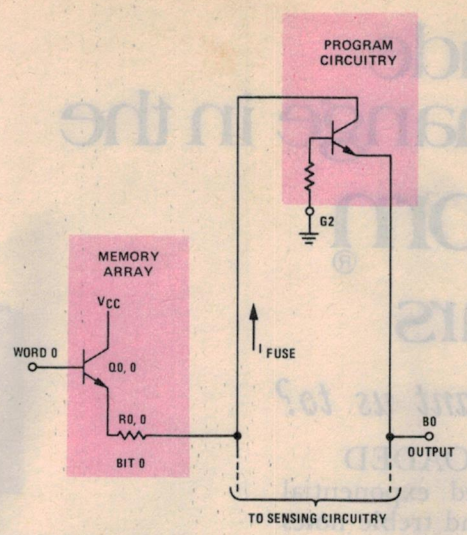

Fig.4: To program a logic 1 into bit 0 of word number 0, nichrome resistor R0,0 is blown by a fusing current of 25-35mA.

The problem can be seen more readily by returning to Fig. 2. The decoder driver selects and drives a single word line. Current then flows through all of the transistors connected to that word line. For example, word line 0 turns on Q0,0 through to Q0,7. That same current flows through all of the unopened nichrome resistor links on that word line, R0,0 — R0,7, and provides base drive for the sense amplifiers QB,0 through QB,7. So that with all of the nichrome resistors present, the output bits B0 through B7 will always read low (logic 0).

If an address circuit or part of the decoders were defective, the fault possibly would not be detected. For example, if portions of the decoder word lines were shorted to each other the output buffers could still all read logic 0's just as if the PROM were operating properly.

This means that a significant portion of the PROM cannot be tested until an actual pattern is inserted into the memory array. For a field programmable ROM, the customer then, not the manufacturer, finds these defects. This is a problem common to many PROMs, but is now solved in Motorola's 512 bit PROM by the addition of a ninth bit, B8, to all 64 of the words in the memory array. (See shaded area, Fig 2.)

The ninth bit is used during manufacturing final test to determine if decoding logic is operating properly. Approximately 16 of the 64 word ninth bits are made with open links. The locations of these open links are chosen such that all of the amplifier inverters, and a portion of the decoders, can be tested during manufacturer wafer probe.

Then, 16 more of the ninth bits are opened by the manufacturer using a method similar to that which the customer would use. This in-house programming checks nichrome-resistor quality on the chip, while at the same time checking drive capability of the program circuitry and word drivers under actual operating conditions. Since all of the ninth bits are physically arranged on the chip to be in worst-case condition with regard to propagation delay, worst-case delay testing can also be done.

At this point, there are 32 of the ninth bit locations left unopened on the tested chip. The customer can now perform his own in-house testing prior to actual programming. These remaining 32 extra ninth bits allow him to test his programming circuitry both for logic capability and for power levels necessary to fuse the nichrome links.

Along with field programmable test bits the logic levels of the MCM5003 / MCM5004 PROM are compatible with all MDTL and MTTL families. This ease of interface offers wide applications possibilities.

A 1024-bit PROM currently being developed at Motorola also has additional bits on the chip to facilitate both manufacturer and customer pre-program testing. Its memory array is expanded from a typical 32 x 32 bit array to a 33 x 33 matrix.

Programming a fusible-link PROM like the MCM5003 / MCM5004 is a quick and easy operation, unlike that required for some other types of PROM on the market. Motorola supply construction details of the simple programming unit shown in Fig. 5, which uses only 13 integrated circuits.

An unprogrammed PROM is placed in the programming socket, and Address Word No. 00 is dialled into the programmer using the set of thumbwheel switches. This addresses the first word location inside the PROM. Then, the word bits to be entered into this first word location are set on the Manual Program switches B0 through B7. The Start Fusing switch is pressed to initiate programming; and once the word has been entered, the Confirm lamp lights. The thumbwheel switch is set to 01 for the next word, and the same programming sequence is repeated until all 64 words have been programmed. Once programmed, the PROM provides non-destructible, read-only memory at fast semiconductor speeds.

If more than one PROM is to be programmed with the same pattern, additional devices can be programmed automatically. The already programmed device is moved over to the Master Device socket, and the Programming Mode switch is set to AUTO. The same sequence as above is followed, except that the most time consuming step of setting the MANUAL PROGRAM switches is performed automatically by internal electronic switching. As many PROMs as are needed can be quickly programmed to the memory pattern initially stored in the Master Device.

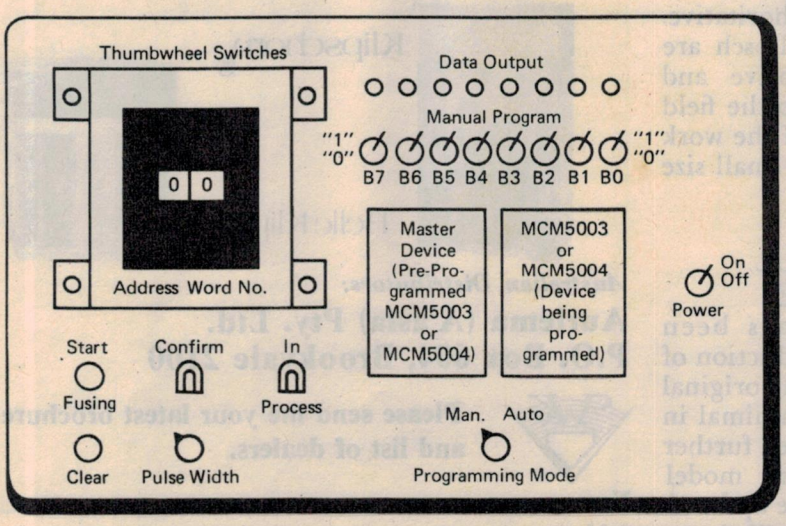

Fig.5: General layout of the programming unit designed for the MCM5003 / MCM5004 programmable ROM (circuit details are available from Motorola). It can function in both manual and semiautomatic modes.

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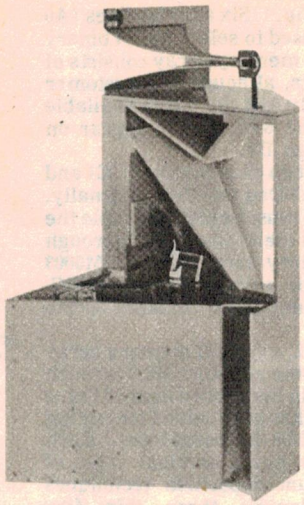

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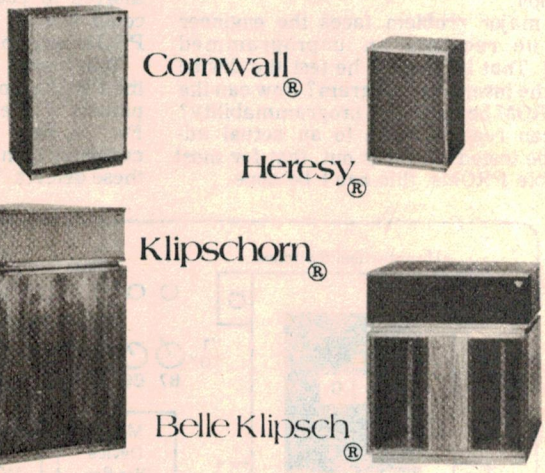

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A 2-Metre Portable FM Transceiver (Part 2)

This second section of the Climie Transceiver description covers most of the circuitry and wiring of the receiver. Main points about the receiver are the automatic scan circuit, the monolithic filter which determines the bandwidth and selectivity characteristics, and the IC which accepts the IF signal and delivers the audio signal. The audio amplifier is another IC.

by FRED JOHNSON ZL2AMJ

15 Byron St, Upper Hutt, NZ.

Inspector of Technical Institutes, NZ Department of Education

The receiver front-end unit is shown in Figs. 4 and 9. Q41 is a gate-protected MOSFET used as an RF amplifier with a second one as the mixer. The received signal from the antenna arrives at L41 and is amplified by Q41 and passed to gate 1 of Q42. The local oscillator signal is fed in at gate 2. The resulting difference signal is taken out from the drain to the receiver tail-end unit.

Alignment is simple — both C42 and C46 are adjusted using the transmitter crystal oscillator as a signal generator and the meter as a level indicator — but more of that later.

It was known at the outset that the success or failure of the tunable receiver would rest on the stability of its oscillator. Experience has shown that a free-tuning single-conversion receiver using a VHF local oscillator is sufficiently stable to be used in portable FM equipment. Many different circuit configurations were considered before the final circuit evolved. Price and simplicity were the main concerns.

A crystal-controlled receiver has long-term stability advantage over the free-tuning arrangement. A single-crystal local oscillator could be switched in to permit long periods of listening on a local repeater channel. A simple additional PCB is under consideration and may be described later. It will provide for the free-tuning receiver as described here, plus fixed-tuned crystal-locked reception.

The oscillator is mounted on its own PCB in a shielded can. Figure 5 shows the circuit of the oscillator unit and Fig. 9 the layout. Q51 is the oscillator and Q52 a frequency doubler, the output being taken via lead 5A. D51 is the varicap diode tuning element which receives its "tuning bias" from the sweep and meter unit (described later). The diode D51 is connected to a positive point rather than common in order to obtain a forward-reading frequency scale on the meter.

The trimmer capacitor C55 adjusts the extent of the frequency excursion or tuning range of the oscillator. C54 adjusts the actual range of frequencies covered, ie, the mid-point frequency or centre-frequency reading. Both trimmers are set up during testing using the transmitter crystal oscillator as a signal generator.

As shown in the block diagram PCB6 is the heart of the receiver. Every receiver function following the initial entrance to the IF channel appears on this board. The circuit diagram is shown in Fig. 6. Two integrated circuits IC61 and IC62 hide most of the action.

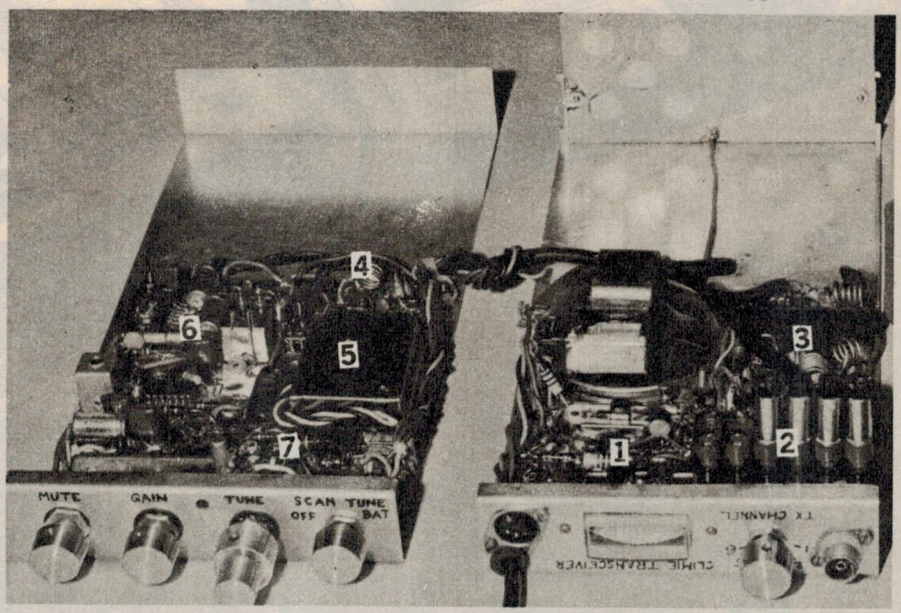
The 10.7MHz IF signal enters via leads 6A and 6B and the tuned circuit L61, C62 and C63. This is in the drain circuit of the mixer Q42. Q61 is an IF amplifier. The bandpass filter F6 sets the receiver overall selectivity. R64 is selected to give the required termination. The filter used was a Nikko Denshi Model D10F20A 10.7MHz and although inexpensive is adequate for the task.

A better (and smaller) filter is the model 1468, available from Piezo Technology Inc, PO Box 7877, Orlando, Florida 32804, USA for about $(US)10. This filter has a 5000 ohm input and output impedance and full details of the modified circuitry for this higher impedance level will be given later (Fig. 20) with suggestions for other developments. This is a 30kHz bandwidth filter with steep sides and is ideal for this application. The 30kHz bandwidth permits some drift in the local oscillator without detracting from performance. Other similar filters can be used provided the input and output terminations are correctly matched.

(Note: The Australian agents for Piezo Technology are General Electronics Services, Pty Ltd, 114 Alexander St, Crows Nest, 2065 NSW.)

Output from the filter is passed to IC61 which contains a large number of functions. It is a CA3089E and contains 94 transistors, several diodes and 62 resistors! Output from IC61 is the audio signal which is taken to IC62 via the audio gain control PO3. IC62 is the audio amplifier which feeds the speaker.

IC61 is the heart of PCB6. The input at pin 1 is low-level 10.7MHz IF. IC61 contains the IF amplifiers, limiters, level detectors, quadrature detector, AGC, AFC, mute



Showing the front panel control labels. The LED is between the "Gain" and "Tune" knobs. Turn picture upside down for better view of transmitter labels. Note battery board with copper areas visible through holes in contact paper. Numbers indicate board positions.

This article is reprinted from the September 1972 issue of "Break-In", the official Journal of the New Zealand Association of Radio Transmitters Inc, by arrangement.

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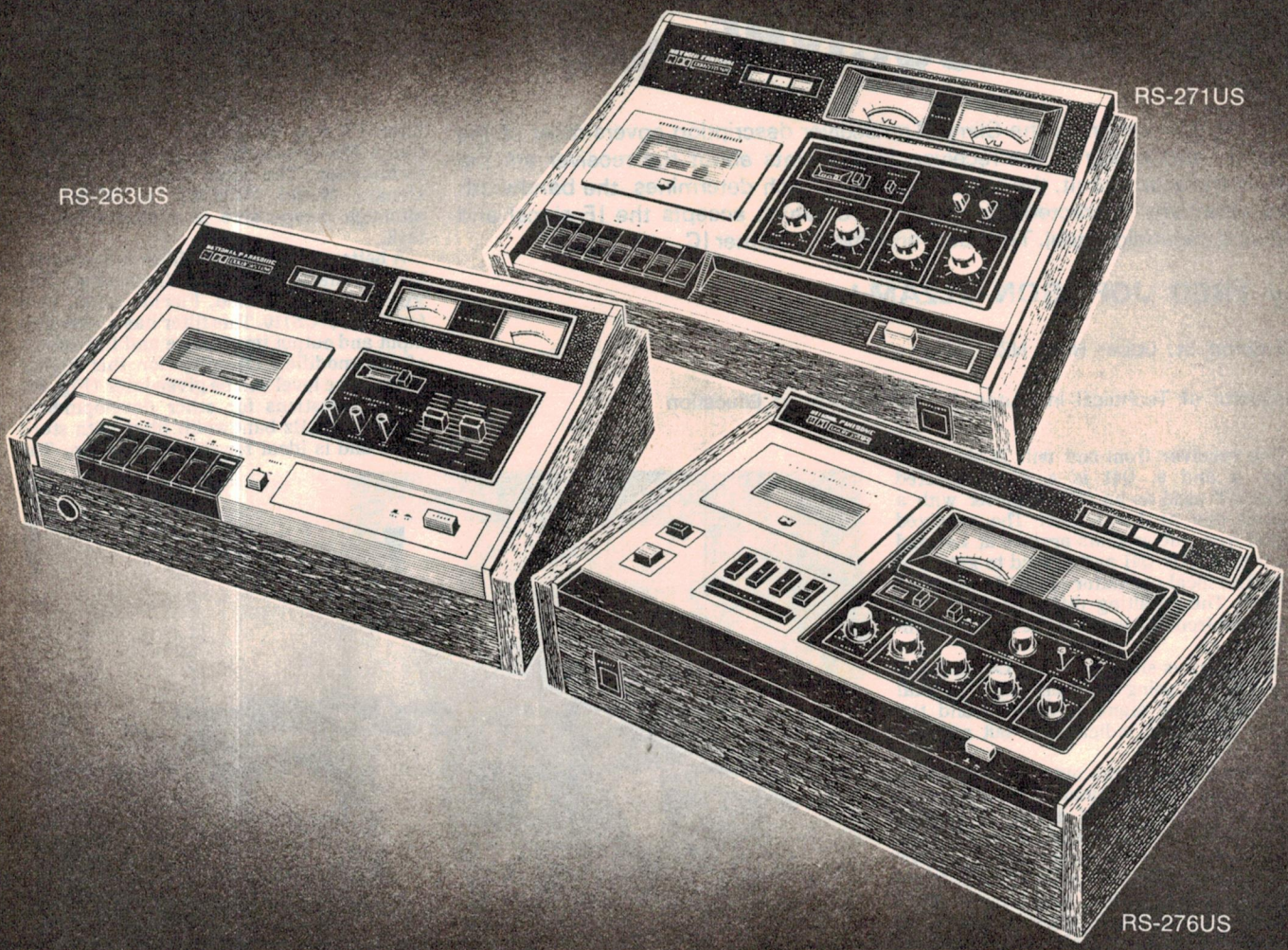

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(squelch) and several other functions. The components connected between pins 7, 8, 9 and 10 are the detector components. L61 and L62 are quite simply adjusted — but more of that later. Lead 15 is a delayed AGC output which is not connected in this receiver. Leads 5 and 12 are the mute connections. Lead 13 is an output used to operate a level meter. This is taken via S61 (in "peak" position) to the transceiver meter. This level meter is used to align the receiver front-end circuits.

The CA3089E is a very interesting device. It is designed for wideband VHF FM broadcast reception and almost nothing has been published on its narrow-band applications. C613 was found necessary to obtain high stability and increased gain in the narrow-band application. The mute circuitry is at first unusual. It operates on the signal-to-noise ratio and the control PO2 sets the signal to noise ratio at which the mute operates — quite unlike the usual squelch. It is very effective and certainly simple to install when all the active components are hidden in the IC!

The data sheet for the CA3089E and an application note describes its use in the wideband VHF broadcasting role. Refer to this for details of its inner workings. The circuit finally used in this application differs in a number of respects from that published. Some components have been omitted and others have had their values changed.

The amplifier Q61 is used to decrease the overall limiting level for the receiver. Without the Q61 stage, the limiting level is about one or two microvolts. With Q61 this is lowered to well below one microvolt. Q61 is placed before the filter because of stability problems due to the wideband high gain of IC61.

A meter is useful in battery-operated equipment for monitoring the battery. Having decided to include a meter it can also be used for other purposes. On receive it indicates the varicap voltage controlling the local oscillator frequency, and can be calibrated directly in frequency. This eliminates a tuning dial. On transmit, it indicates the RF voltage to the antenna and provides a check on transmitter performance. The meter can also indicate received signal strength, which is useful for alignment.

Fig. 7 shows the receiver tuning, metering, and scan oscillator arrangements. It also shows the function switch and tuning potentiometer circuits. Each section will be taken in turn because each section and each function is basically quite simple. Layout is shown in Fig. 10a. R71, D71 and the LED provide an 8 volt stabilised supply for the receiver control and oscillator circuitry. It runs all the time the set is on and is not affected by the transmit / receive relay. SO1 is the function switch and main on / off switch. This provides choice of scan, tune, or battery test functions. SO1A is the main battery on / off control.

Let us examine the voltage-divider chain R74, PO1A, PO1B, and RO5. With SO1B at "tune" the wiper of PO1A provides the DC bias across the oscillator control varicap D51 via RO2. The "tuning bias" at PO1A wiper ranges from 3.0 to 6.0V (approximately) and is a measure of the receiver frequency.

Q72 and components R79, R710, R712, R713, R711 and the meter form an electronic-voltmeter. This is necessary to minimise the load on the high-impedance tuning-bias circuitry. It is a conventional bridge voltmeter, arranged so that when the PO1A wiper is at the low voltage end the meter reads full scale, and when at the high-voltage end the meter reads zero.

Trimpot R712 adjusts the meter for zero reading with PO1A at its high voltage limit, while R711 adjusts for full-scale current with PO1A at its low-voltage end. Running PO1A end to end therefore traverses the meter needle across its complete scale and simultaneously tunes the receiver across the band.

The fine-tuning control uses the other section of the concentric pot. It is padded to an effective 56k variation by means of RO1. Because of the logarithmic taper on PO1B, one end of the track should be shorted in preference to the other — to give a more

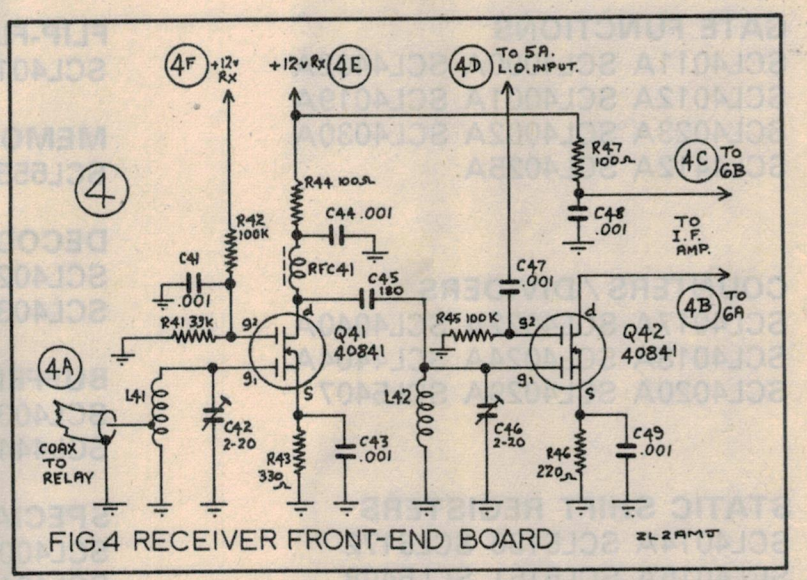

FIG.4 RECEIVER FRONT-END BOARD ZL2AMJ

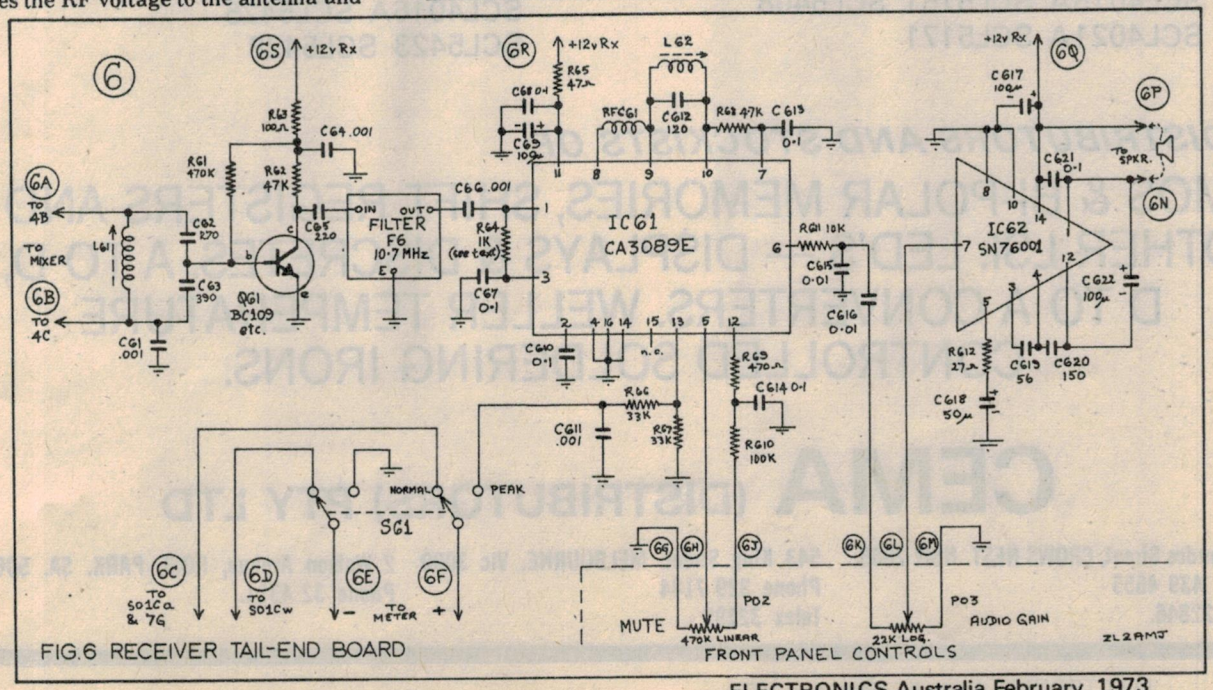

FIG.6 RECEIVER TAIL-END BOARD ZL2AMJ

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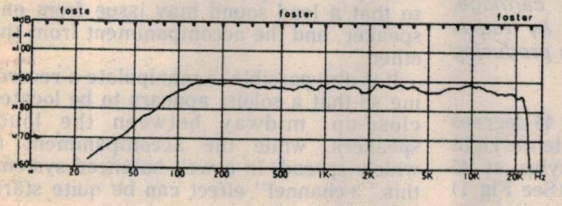

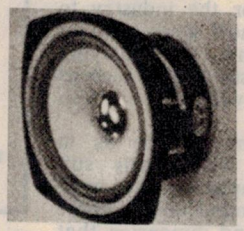

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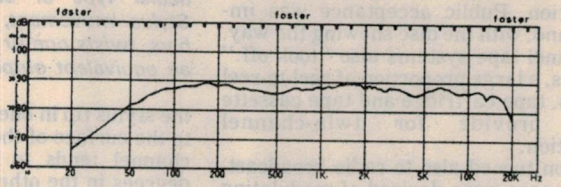

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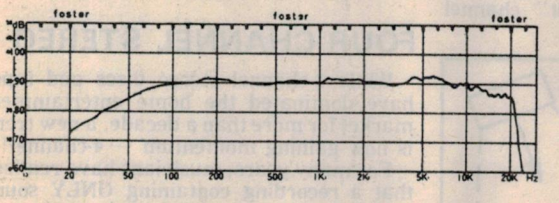

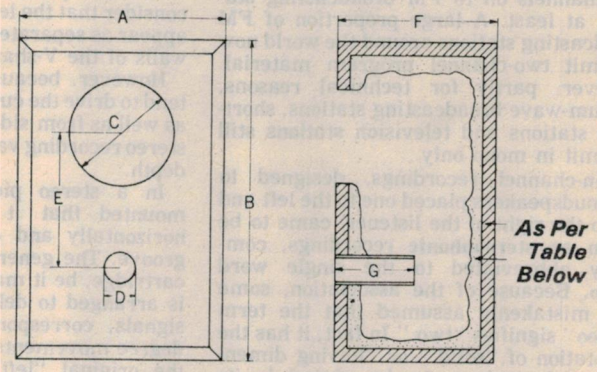

	A	B	C	D	E	F	G	Capacity
UP-103	280	430	108	50	150	200	50	15 ℓ
UP-133	300	465	129	60	187	240	60	26 ℓ
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two substantially independent audio signals in the one groove. By using a suitably designed pickup cartridge, the two signals could be recovered and fed via two amplifiers to separate loudspeakers, one to the front-right and the other to the front-left of the listening position.

A fortunate aspect was that a twin-channel recording, as proposed, could use the existing microgroove standards for disc size and speed, with only a minor variation in the exact groove dimensions. The way was open, therefore, for the industry to introduce a complete new generation of twin-channel records and record playing equipment, on which existing mono records could still be played — without the stereo effect, of course.

While there was some debate as to whether two channels were really sufficient, it soon became apparent that well-recorded two-channel sound could create the sense of direction and dimension that was so obviously missing from mono reproduction. Public acceptance was immediate and, with the disc showing the way, twin-channel tape systems also "took off." Nowadays, a large proportion of reel-to-reel machines, tape cartridge and tape cassette players provide for twin-channel reproduction.

Attention turned also to radio broadcasting and means were devised of modulating two channels on to FM broadcasting stations, at least. A large proportion of FM broadcasting stations around the world now transmit two-channel program material. However, partly for technical reasons, medium-wave broadcasting stations, short-wave stations and television stations still transmit in mono only.

Twin-channel recordings, designed to feed loudspeakers placed one to the left and one to the right of the listener, came to be known as **stereophonic** recordings, commonly abbreviated to the single word **stereo**. Because of the association, some have mistakenly assumed that the term "stereo" signifies "two." In fact, it has the connotation of "solid," or "having dimension" and needs to be broadened in its usage. We should strictly be talking here about "two-channel stereo," bearing in mind that certain other stereo sound systems (as in large theatres) use more than two channels.

Stereo disc records and stereo disc record players — or **stereograms** — are now virtually standard in Australian homes.

Conventional disc recordings, carrying only the one signal, are known as **monophonic** or simply **mono** records. (The term **monaural** should be avoided in this context, since it really means "one ear.")

Just as there are mono and stereo disc recordings and playing equipment, so there are mono and stereo tape recordings and players.

To all appearances, a stereo disc record looks the same as a mono record but there is a vital difference in the way in which the groove is inscribed.

In a conventional mono record, the groove deviates laterally and causes the pick-up to generate a signal when its stylus is vibrated from side to side.

For a stereo record, a special cutting head is used in which the stylus tip is driven obliquely and independently by "left" and "right" signals, fed to different driving coils. The left channel signal tends to drive

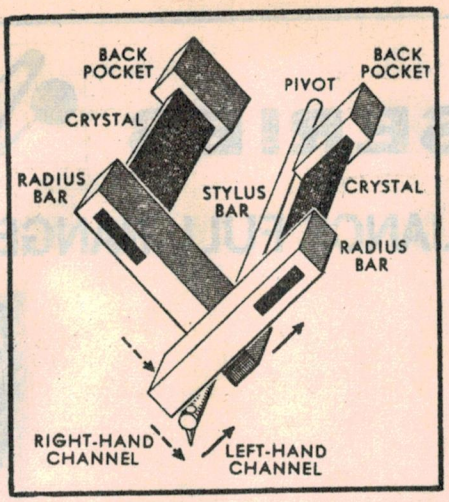

Fig. 2: A simplified illustration of one particular type of stereo crystal cartridge. Stylus movement, transmitted by radius bars, twists one or both crystals producing an equivalent output.

the stylus tip in one direction, at 45 degrees to the surface of the record, while the right channel tends to drive the stylus at 45 degrees in the other direction. (See Fig 1)

For all practical purposes one may consider that the left and right-hand signals appear as separate indentations on opposite walls of the V-shaped groove.

However, because the recorded signals tend to drive the cutting stylus up and down, as well as from side to side, the groove in a stereo recording varies both laterally and in depth.

In a stereo pickup, the stylus is so mounted that it can move vertically, horizontally and obliquely to follow the groove. The generating system inside the cartridge, be it magnetic or piezo electric, is arranged to deliver two distinct output signals, corresponding to respective 45-degree movements of the stylus tip and to the original "left" and "right" channel information. (See Fig 2.)

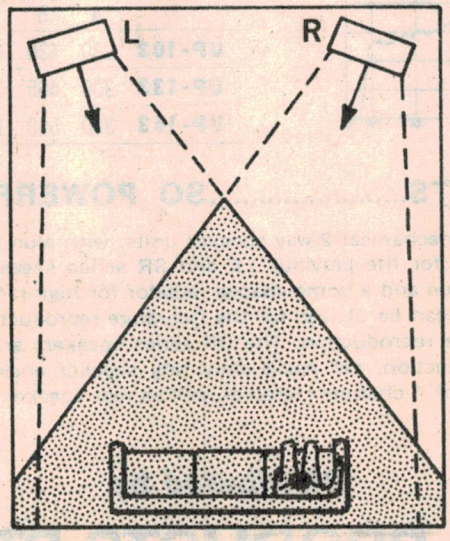

Fig. 3: A typical listening room situation for 2-channel stereo. A virtual sound image can be created at least as broad as the space including and between the two loudspeakers.

The two signals so produced are taken through two amplifiers to separate loudspeakers placed, preferably, several feet apart. To listeners seated in front of the loudspeakers, the sound appears to be spread out in a much more natural fashion than is possible from a mono system.

It is generally agreed that, for ordinary domestic listening, the loudspeakers should be about ten feet apart, while the optimum listening position is towards the opposite end of the room, as indicated in Fig 3.

Perhaps it should be mentioned that producers of stereo recordings follow various techniques to secure the effect they want.

Classical orchestral records are generally recorded in such a way as to produce an even spread of the orchestra across the intervening space between the loudspeakers. Some popular music is recorded this way also.

However, plenty of popular music is arranged to emphasise channel separation, so that a lead sound may issue from one speaker, and the accompaniment from the other.

It is also possible to manipulate a recording so that a soloist appears to be located close-up, midway between the loudspeakers, while the accompaniment is widely spread. In a well balanced system, this "3-channel" effect can be quite startling.

Stereo records should only be played with stereo pickups, since these can be expected to have the necessary lateral and vertical **compliance** (i.e. the ability to move in a lateral or vertical direction) to follow the modulation in the stereo groove.

While a mono pickup may seem to play a stereo record and produce from it an acceptable mono signal, there is a chance that it will damage the groove in so doing, particularly if it is an old style cartridge having very little vertical compliance.

However, while a mono pickup should not be used with anything but mono records, a stereo pickup can be used freely with either stereo or mono records.

FOUR-CHANNEL STEREO

While 2-channel stereo discs and tapes have dominated the home entertainment market for more than a decade, a new trend is now gaining momentum — 4-channel!

For many years, musicians have realised that a recording containing ONLY sound information obtained from the performers may be precise — but may also be lacking in "atmosphere." Recordings may benefit by the presence of some natural reverberation from the auditorium or recording studio. In actuality recordings, a certain amount of audience noise can increase the sense of listener involvement.

This kind of "ambience" is present in most mono and 2-channel stereo recordings, being achieved either by placing the microphone(s) sufficiently far away from the performer(s) or by deliberately mixing with the main channel the output from one or more remote microphones.

While this contributes to the enjoyment of present-day recordings, it has the disadvantage that the reverberation and audience noise comes through the main loudspeakers in front of the listener, whereas it should be coming from beside and behind the listening position.

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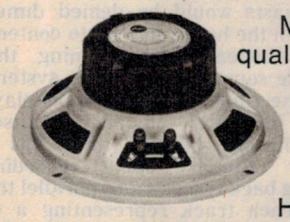

Manufacturers of high quality radios and record playing equipment choose Plessey components as a matter of course.

Hi Fi enthusiasts have learned that Plessey loudspeakers, kits and enclosures meet their demands for perfection without injuring their wallets.

Plessey has a long standing reputation for perfection to protect . . . we cannot compromise on quality or fidelity in our products.

The Plessey Pacific group in Australia is part of the giant Plessey company based in the U.K. Their interests range over the broad fields of components, equipment and systems for the telecommunications, electronics, aerospace, hydraulics and related industries.

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APP67

Stereo Sound Reproduction

Limitations of mono reproduction. The search for sound "dimension". Two-channel stereo discs. Two-channel stereo in the home. The latest concept: 4-channel sound. Simulated 4-channel reproduction. Matrix-type 4-channel disc records. The CD-4 or "discrete" 4-channel disc record.

In the discussion of radio receivers and audio amplifiers to this point, it has been assumed that the objective has been to transmit, or record, or amplify, or reproduce one distinct audio signal — be it music, speech, sound effect or a mixture of all three. In short, we have assumed a single channel or **monophonic** signal — a term that is commonly abbreviated to **mono**.

Up to about 1950, it was scarcely necessary to consider anything else, because most familiar sound reproducing systems employed only a single channel — medium-wave broadcast receivers, television receivers, sound motion pictures, and tape and disc recordings.

Apart from the cost and complexity of providing more than a single sound channel, there appeared to be no strong demand for anything more elaborate. The most obvious requirement was for clean, enjoyable sound at an adequate power level and free from distortion. Even today, most ordinary broadcast, short-wave and television stations provide only single-channel (or mono) sound, as do most film theatres for most of the time.

Audio signals can be extremely complex containing, as they do, "information" about the frequency, phase and amplitude of each individual component of the original sound. However, a mono signal contains no information about the direction from which the original sounds came relative to the microphone (or microphones).

Thus, while an orchestra may be heard and enjoyed as a whole, it is not possible to nominate from the reproduced sound the relative positions of the original instruments or instrumental groups. At best, one might guess that the violins were at the left, percussion at the rear and so on, but there is no way of being sure.

This remains true, whether the original sound is picked up by one microphone or by several. Information relative to direction is lost immediately the total signal is combined into a single amplifier or a single recording or a single transmission channel.

Once "directional" information has been sacrificed there is no way in which it can genuinely be recovered. At best, it can only be subsequently contrived or faked.

Over the years, generations of audio enthusiasts have tried, in a variety of ways, to counter the lack of directional information in single-channel sound and to achieve a more natural sense of spread, or dimension. They have sought to get away from the impression of all the sound issuing from one localised source, as if it were coming through a small round hole in the studio wall! In fact, monophonic reproduction is sometimes referred to, derisively, as "hole-in-the-wall" sound.

In an effort to overcome this effect, some have exploited the use of multiple loudspeakers, woofer / tweeter combinations, &c, with the individual units widely separated. Others have mounted loudspeakers at oblique angles, to bounce the sound from adjacent walls and thus render the actual sound source less apparent.

At best, however, such measures can only be a palliative and no real substitute for the directive quality missing from the reproduced sound.

Audio engineers have known for the best part of 50 years that directional qualities could be imparted to sound reproduction by using multiple channels. For example, a number of microphones might be ranged in front of an orchestra and their signals conveyed directly, or by way of a multi-channel recording, to as many loudspeakers similarly placed in front of a remote audience.

The loudspeakers will then virtually reconstitute the "spread" of the original sound, allowing the audience to listen selectively to individual sections of the orchestra.

The real problem was to take advantage of this basic knowledge, without running into unacceptable complexity and cost.

Its first important practical application was to the sound tracks of large-budget feature films. Signals from multiple microphones and other sources were recorded optically (later magnetically) onto the release prints. After amplification, the signals were fed to loudspeakers ranged behind the screen and even, in some cases, around the auditorium itself. By such means, it was possible to have sounds coming from left, right or centre, appropriate to the visual action, and to reproduce orchestral music with a real sense of spread.

However, it was one thing to provide multi-channel sound in a theatre; it was quite another to envisage multi-channel sound for ordinary listening in the ordinary home situation — no matter how desirable it might seem from the viewpoint of realism, therefore of ultimate fidelity.

In terms of radio broadcasting, there appeared to be no easy way to superimpose multiple signals on the one station carrier, while it was equally impractical to allot more than one transmitter to each program — to say nothing of the need for more than one receiver in every listening room.

Similarly, there seemed no easy way to record multiple signals on the one track of a disc record — or at least not without introducing serious attendant problems.

Until the mid-fifties it seemed that audio enthusiasts would be denied dimensional sound in the home, having to content themselves instead with winning the best possible sound from a mono system.

At the time, magnetic tape players offered the most obvious promise of a breakthrough, because there was no particular difficulty about recording and playing back two or more parallel tracks on tape, each track representing a discrete microphone / loudspeaker link. However, the domestic mass market was not ready for tape and tape players in any form, let alone in one which would demand multiple amplifiers and loudspeakers!

Nevertheless, a potential demand was there and disc recording engineers began to consider seriously the possibility of adapting to microgroove records an idea that had been put forward by the brilliant British engineer Blumlein in the early thirties. This offered a means of recording

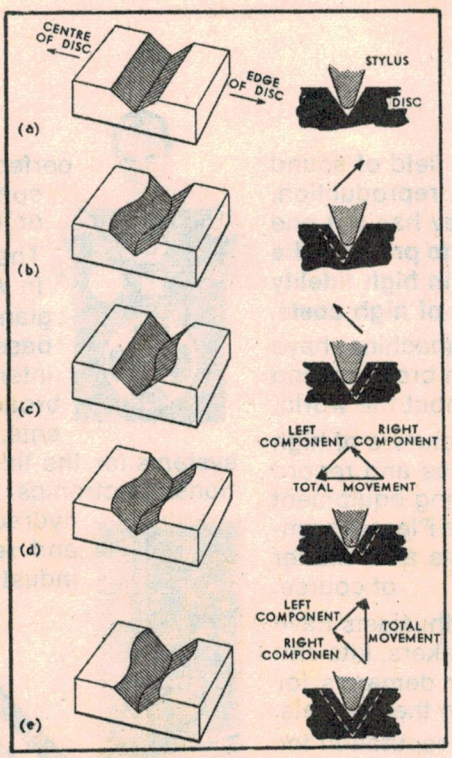


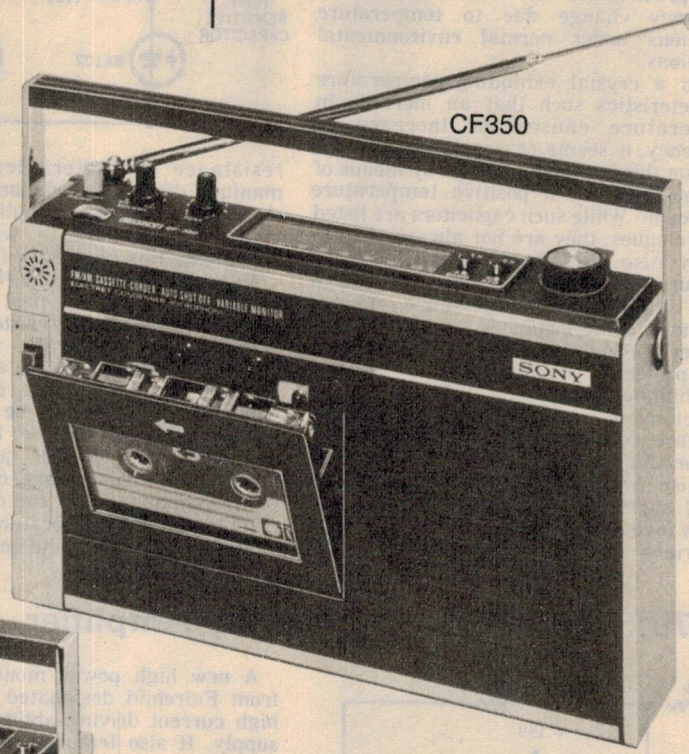
Fig. 1: The basis of a 2-channel stereo recording. (a) plain groove; (b) left-hand channel modulated; (c) right-hand channel modulated; (d) both channels modulated in phase; (e) both channels modulated out of phase.

Sony's compact new cassette-corders turn you on and turn themselves off

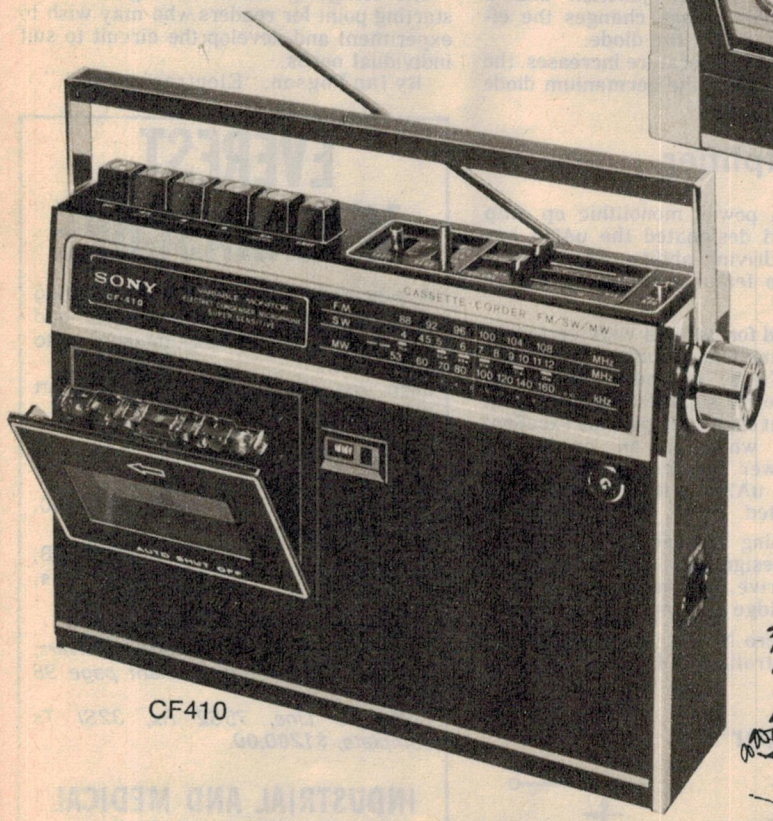
So you want the best of both worlds — you're a mover who likes your music on the run, likes to tape your favourite radio at the touch of a button or record your own impressions as casually as a coffee table conversation. Sony's latest cassette corders ingeniously fit high quality components into stylishly portable shapes, give you the same joy of handling as a fine camera yet they're simplicity itself to operate.

Both have the convenient auto shut off feature that lets you start it and forget it — if you want to. And both include Sony's ingenious swing balance mechanism so you can record even as you travel.

The smaller CF-350 weighs only 4 lbs. 3 oz. yet produces astonishingly good sound for its output.

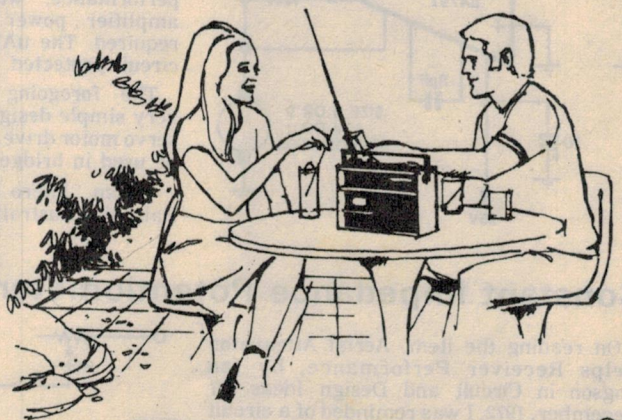


CF350



CF410

The classic CF-410 includes an FM/MW/SW radio combination and one button for quick location of any point on the tape. Tape counter, too. Sony-o-matic automatic recording level control and 4-way power sources are other features.



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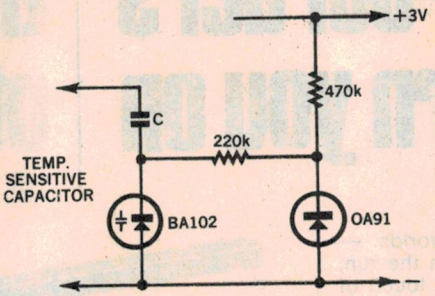
SN1975

Temperature Sensitive Capacitor

Recently, the writer has been carrying out some private work on a crystal oscillator where high stability is of prime importance. Apart from care being taken with the type of circuit used and good quality components and construction, the next problem to be solved is that of frequency change due to temperature variations under normal environmental conditions.

With a crystal exhibiting temperature characteristics such that an increase in temperature causes an increase in frequency, it seems reasonable to attempt to offset this frequency change by means of a capacitor with a positive temperature coefficient. While such capacitors are listed in catalogues, they are not always easy to obtain. Also, the amount of positive temperature coefficient may not be enough to offset the crystal temperature characteristic in some instances.

After a certain amount of research into the problem, thought turned to the possibility of using a silicon diode variable capacitor, in a circuit which was temperature concious. The possibility of incorporating a thermistor seemed to show promise, also the reverse resistance of a small signal germanium diode would be worth investigating. While the former was not ruled out, a check on the reverse



resistance characteristics of the germanium diode showed such a dramatic change in resistance for quite a reasonable temperature change, it was decided to investigate this possibility further.

As may be seen from the circuit, the germanium diode is part of a voltage divider, with a stable resistor as the other part of the divider. The voltage at the divider junction is fed via a 220k isolating resistor to the silicon diode variable capacitor. It may also be seen that the silicon diode is reverse biased by the voltage at the divider junction and a variation in bias voltage changes the effective capacitance of the diode.

If the ambient temperature increases, the reverse resistance of the germanium diode will be reduced, the voltage at the junction of the divider will fall and the capacitance of the silicon diode will increase. In short we have achieved, albeit by devious means, a positive temperature coefficient capacitor. It is also worth noting that simply by reversing the positions of the resistor and germanium diode in the divider, a negative temperature coefficient may be achieved.

The circuit shown may be considered as typical but components and parameters may be varied considerably to vary the amount of capacitance change to suit the particular situation. The capacitor C may only be needed for DC blocking purposes, in which case it will be a high value compared with the capacitance of the silicon diode. Alternatively, C may be made smaller so that it restricts the effect of the silicon diode. The 220k isolating resistor is not critical provided it does not affect the Q of the circuit. This value is a safe minimum.

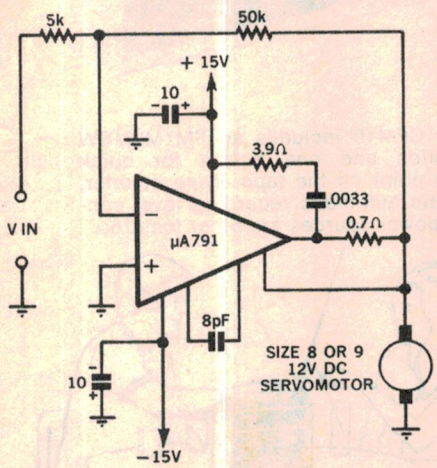
The OA91 used had a reverse resistance of the order of 1M. This may vary quite a bit, particularly if a different type or brand is used. The BA102 under the circuit conditions had a capacitance of 36pF. Again, this can vary over quite wide limits, due to production spreads, etc.

While we were not able to make any accurate temperature versus capacitance measurements, several pF changes could be effected with only a few degrees Celsius variation.

The foregoing details are given as a starting point for readers who may wish to experiment and develop the circuit to suit individual needs.

(By Ian Pogson, "Electronics Aust.".)

uA791 Monolithic Operational Amplifier



A new high power monolithic op amp from Fairchild designated the uA791 has high current driving ability: 1A at ±12V supply. It also features automatic circuit protection.

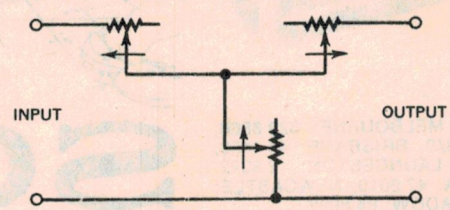
It is intended for use in a wide variety of applications including audio amplifiers, servo amplifiers, magnetic deflection circuits and power supplies. The high gain and high output capability provide excellent performance, wherever an operational amplifier power booster combination is required. The uA791 is thermal and short circuit protected.

The foregoing characteristics permit very simple design for a bi-directional DC servo motor drive, as shown, and it can also be used in bridge type servo applications.

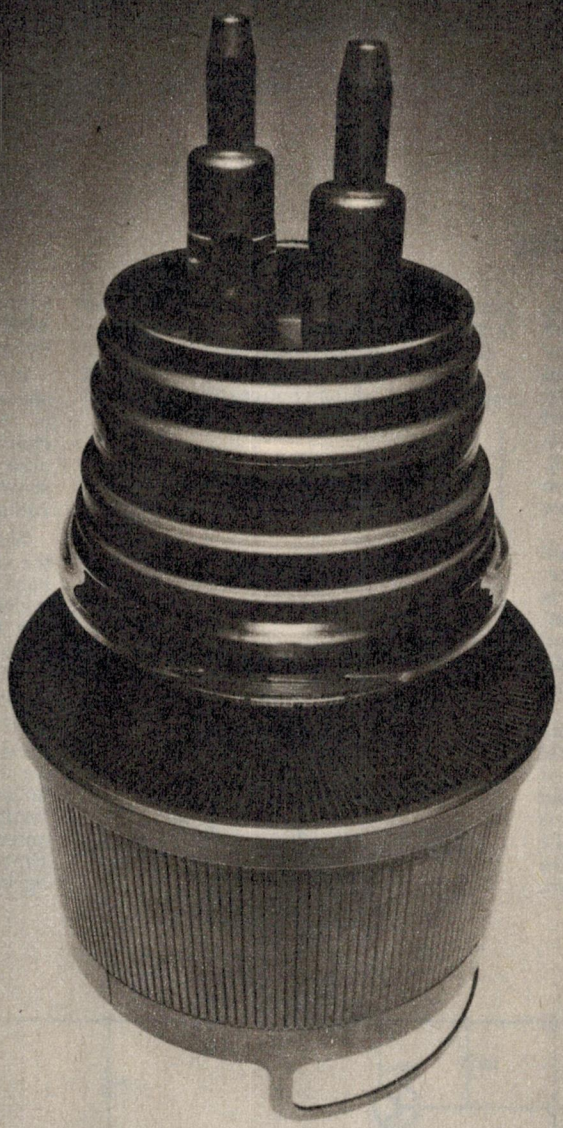
(From "Micro News" — by courtesy of Fairchild Australia Pty Ltd.)

Constant Impedance Potentiometer

On reading the item, Aerial Attenuator Helps Receiver Performance, by Ian Pogson in Circuit and Design Ideas for December, 1972, I was reminded of a circuit arrangement which I came across when I was with the PMG Department. The circuit is shown herewith. All potentiometers are linear and of equal value. They are ganged together and regardless of the shaft position, the impedance across the line remains the same.



(By Mr P. J. Grigg, Lot 44, Glenburn Street, Newcomb, Vic 3219.)



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CIRCUIT & DESIGN IDEAS

Interesting circuit ideas and design notes selected by the Editor from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Contributions to this section are always welcome.

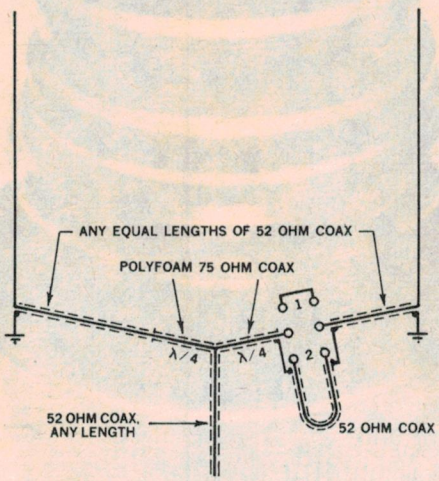
Phased Vertical Antennas

Two identical vertical antennas can be installed as a phased array. When excited directly by RF energy, gain is achieved by control of the directional pattern control results in added gain by sharpening lobe patterns and concentrating the radiated energy at very low angles. Signal flutter is reduced and reception is vastly improved. Phased arrays will reduce installation height requirements and still maintain low angle radiation.

Most effective spacing for a bi-directional array is half wavelength. When two verticals are excited in phase the radiation is broadside to the plane of the verticals, offering a gain of 3.8dB and bi-directional characteristics. Side attenuation of 30dB gives good signal reduction for the undesired direction.

When excited out of phase, these same verticals give an end-fire or bi-directional pattern in the direction through the plane of the verticals. Signals are then nulled out in the broadside directions. More gain is exhibited by the broadside pattern over the end-fire arrangement but the end-fire arrangement offers a wider frontal pattern. Forward gain is 2.3dB and side attenuation is 20dB.

Both arrangements offer advantages over a single vertical since either phasing combination exhibits noticeable signal gain with side attenuation of undesired signals. Added gain and low angle vertical directivity are features of the phased array.



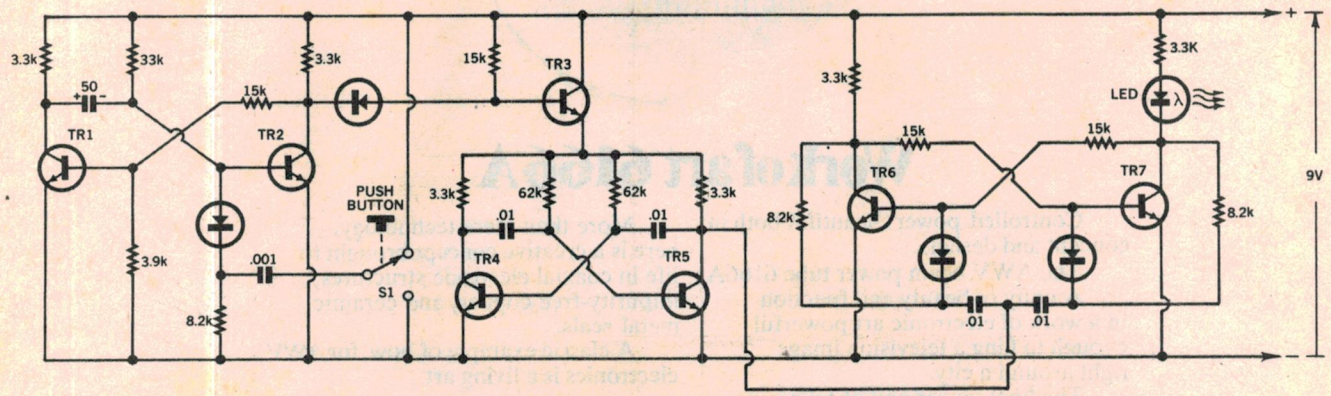
Phased verticals may be spaced either one quarter wave or one half wave resulting in variations in gain and directional characteristics. The nulls of the phased array are very sharp. One arrangement is shown in the diagram, together with radiation patterns.

When both feedlines to the verticals are the same length, the currents arrive at the base of each antenna at the same time, giving the in-phase broadside pattern. When one feedline is a half wavelength longer than the other, the current arrives at the base of one antenna before the other, giving the out-of-phase end-fire pattern.

(From "Hy-Gain Engineering Report".)

Editorial note: Due to space restriction, we are only able to give part of the information available on these antennas and further inquiries on the range of Hy-Gain antennas may be directed to Sideband Electronics Engineering, PO Box 23, Springwood, NSW, 2777.

Decision Maker



Operation of this circuit may be considered as analogous to the tossing of a coin. Most of the circuit components used were from computer boards, although other readily available components could also be used. The circuit is relatively simple.

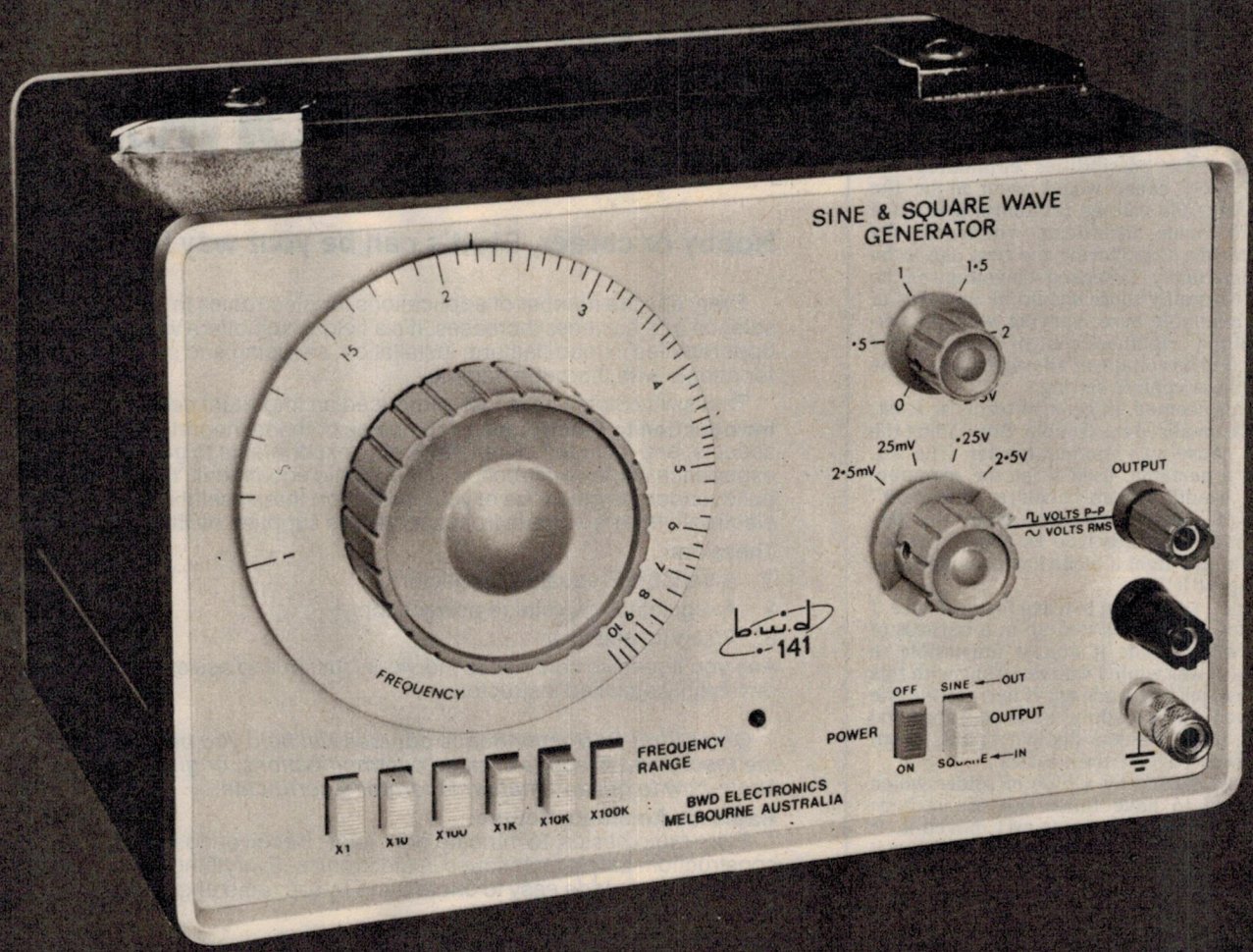
The monostable consisting of TR1 and TR2 is triggered by S1 and causes TR3 to conduct for the period of the monostable, the time being approximately 1 second. This in turn switches on the astable multivibrator consisting of TR4 and TR5 and during this period, the number of output pulses varies somewhat according to transistor cutoffs etc. The output pulses are fed to a flip-flop which performs a divide-by-two counting function with a light emitting diode in the collector of one of the transistors. This gives an indication of the final state of the flip-flop. If an even number of pulses are fed into the flip-flop, then the output will revert to its original state. If an odd number of pulses are fed in, then the opposite will be true and hence the equivalent to a heads-tails function.

During activation, the LED will appear partially illuminated but will actually be switching on and off rapidly. If the light output is unsatisfactory, the collector resistors of the flip-flop may be reduced equally. If the read-out function is not random enough, the speed of the astable multivibrator may be increased by reducing the value of the two 62k resistors.

(By Mr S. Thompson, 46 Cornwall Road, Auburn, NSW 2144.)

Editorial note: While we are aware that there are simpler ways of doing the above, the exercse involves three different types of multivibrator and thus could provide valuable experience for students and experimenters.

The bwd 141 with 99.9% purity of output is so beautiful.



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the video stage.

Alternatively, and as in the case I am about to describe, the screen may be devoid of an image of any kind, and produce no response to the brightness control. Assuming that the picture tube itself has not failed, this usually means that the operating voltage to one or other of the tube electrodes is incorrect. This can range from the EHT on the final anode, to the voltage applied to the cathode.

In this case there was one simple clue that indicated that at least two of these possibilities could be ruled out. On switching the set off a bright spot appeared in the centre of the screen and lingered for several seconds. This suggested that (a) the picture tube was functioning and (b) that the EHT system was functioning.

With these possibilities eliminated the most likely cause would seem to be the grid / cathode voltage relationship or, as a second choice, insufficient voltage on the first anode. Considering the first one to be the more likely, I checked the voltage on the grid. Normally there should be upwards of 160V available here, varying with the setting of the brightness control. In this case I could find no voltage at all, regardless of the brightness control setting.

Which seemed, in general terms at least, to have localised the trouble. But finding the exact cause was another matter. The set, being a portable, used what the manufacturer would probably call a "compact" form of construction; and what the serviceman would describe as being "packed in so flamin' tight a bloke hasn't a chance of getting at it!"

In fact, as I set out to trace the grid wire, I realised that it was tied up in a harness of wire which made it almost impossible to follow. It was while I was wrestling with this harness, prizing leads apart to trace the one involved, and with the chassis held at an odd angle, that I heard a distinct "plink" from the lower edge of the chassis.

It was caused by a blob of solder which appeared to have fallen out of, or been disturbed by, the harness as I moved it. It was about 3 / 16in diameter, with a tail on it about ¼in long; quite a formidable lump of metal to be floating around loose in a TV chassis.

Could this be the cause of the trouble? It was an idea worth a try, at least. I switched on and waited for things to warm up. Sure enough, up came both sound and picture, together with a normal voltage on the grid.

Had I fixed it, or was it intermittent? A thorough bashing, plus a prolonged test on the bench suggested that I had indeed fixed it. So I returned it to the owner, gave him a suitable warning, then followed this up a week later. I was assured that the set had not missed a beat since.

So there it was, a blob of solder left by a careless wiring operator and which, apparently, had remained dormant during all the factory tests and for several years in the field. Just why it had chosen to give trouble at this time or, indeed, exactly where in the chassis it had been located, is anybody's guess. However, it seems almost certain that it was shorting the picture tube grid to chassis.

In some ways, a mildly frustrating case, since I would have liked to know the exact details. On the other hand, I probably finished the job a lot quicker than if I had had to trace that lead right through the harness, so I shouldn't complain.

THE SERVICEMAN

Catching a Set That Bounces

Nobody likes the idea of a service job that "bounces", ie, is returned because the original fault appears not to have been fixed. Nevertheless, it does happen and, when it does, we should accept the situation as philosophically and as gracefully as possible.

The truth is, it is not so much the set which bounces that we should worry about; it is the one which should have bounced, but didn't. The customer who complains is giving us another chance; a chance for which we should be duly thankful and of which we should take full advantage.

The customer who has reason to complain, but doesn't, has written us off. He has sought the services of some other serviceman who, with any luck at all, will find the fault and gain a customer for life. I say, "with any luck", because it is almost inevitable that he will benefit to some extent from what we have done. At the very least, the fact that someone else has tried and failed will put him on guard; make him aware that this is a tricky one. In some cases he may even learn something of what was tried — and failed; which puts him just one jump ahead of the serviceman who tried it.

Guarding against such a situation is not simple. While we may feel sufficiently confident to "guarantee" any particular job, and the parts and workmanship associated therewith, there is always the risk that the customer will misconstrue this as covering the entire set and its performance. The result can be endless arguments and recriminations, usually culminating in the serviceman doing a job for nothing anyway, simply to preserve goodwill.

What is the answer? Well, for one thing, always make it easy for the customer to approach you on such problems. Particularly where the fault has been a tricky one, and where there may still be a lingering doubt as to whether it really has been found and fixed, I always ask the customer to contact me if he suspects that the fault has reappeared. Better still, take the initiative yourself and make a follow up inquiry after a week or so.

Once you build a reputation for being approachable, and of taking a genuine interest in the jobs you do, you will usually be given the opportunity to try again — and to retain your customer.

As you've probably guessed, it was a recent job which inspired that little burst of philosophy; one that could have posed just such a problem had I been less fortunate.

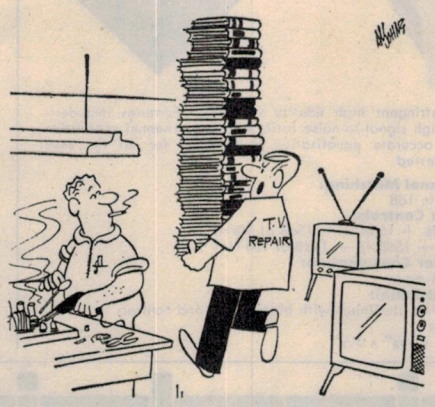
It concerned a 17in so-called portable TV set. It was a hybrid device, employing some transistors and some valves. The complaint was stated simply as "no sound"; a relatively simple fault as a rule, not likely to put one on guard. The only warning was a rather vague statement by the owner that, "it goes all right sometimes".

On the bench it behaved as he had described it; a good picture but no sound. The circuit showed that the audio section consisted of three transistors and a 6BQ5 output valve. Mainly because it was the easiest thing to do, I pulled the 6BQ5 out and pushed in another one. And, hey presto, up came the sound as clear and strong as one could wish. So, after running it on the bench for a couple of hours, and touching up the height and linearity controls, I returned it to the customer.

Two days later I received a phone call from the customer. Somewhat diffidently he explained that the set seemed to be playing up again and suggested that I might take another look at it. He also hinted that he hoped it was not going to prove too expensive.

I suggested that he bring it back to the shop and let me have another look at it. I also assurred him that I "would do the right thing" if it transpired that the fault was mine. Thus reassured, he lost no time in bringing the set around.

I took the opportunity of trying it while he was still there. Imagine how we both felt when the sound came forth loud and clear, and seemingly immune to any superficial proddings or bashings. I imagine he felt slightly foolish, while my own feelings were mixed. I was glad it had displayed its temperamental behaviour when it did; it would help convince him that I had acted in good faith. On the other hand, it suggested that the fault could be a tricky one.



"The hard part of this job is trying to keep up with all the advances in the field." (Radio Electronics)

I set it up on the bench, in the corner reserved for such rogues, and went on with other jobs. But after several hours, during which time it never missed a beat, I became impatient. Having finished what I was doing I decided that a few well chosen jabs or prods might be worth while, if only to eliminate some of the more obvious components as being not involved.

Accordingly, I went over every component and every joint in the audio section, applying pressure and tapping, in an effort to make the system fail. No luck; as far as I could determine, there were no intermittent components and no dry joints anywhere in that section. It seemed that the next step would have to be hot and cold cycles. Either that, or just wait.

At this point I had an idea. One part of the audio system which I hadn't checked was the speaker. I picked up a nylon aligning tool and used it to apply pressure to one of the voice coil leads. Immediately, the sound cut out. It returned when I removed the pressure, but I found I could control the behaviour quite reliably.

This much established, I felt that the rest would be easy. Voice coil leads sometimes develop a dry joint at either the terminal on the frame or where they are secured to the cone. Judicious application of heat, solder and flux should fix that.

Only it didn't. I resoldered all four joints without achieving anything. At which point I was forced to the conclusion that the fault was in the voice coil itself, in which case there was little that I could do to salvage the speaker.

The unfortunate upshot of this was that I had to fit a new speaker. While not a gross expense, it did create the rather delicate situation whereby I had to charge the customer for it. Since he had already paid me one service fee, and the price of a valve which I now realised need not have been replaced, this called for some diplomacy.

Naturally, I waived any fee for the second call, since it clearly should not have been necessary. On top of this I deducted the price of the valve from my normal profit margin on the speaker which meant, in effect, that I supplied the speaker at about cost price.

Not a very profitable job? No, it wasn't. But that's the way it goes sometimes and one simply has to absorb it in the overall cost of running a business. The important thing is that I have retained the customer's goodwill — and my reputation.

Both will be worth a lot more in the long run.

My next story also concerns a portable TV set, an 11in model this time. By contrast, its complaint was sound but no picture. The term "no picture" can have a variety of meanings, in the technical sense. For example, the raster may still be visible and respond to the brightness control, but lack video information. Such a situation tells us quite lot about what not to check. For example, it is obvious that the whole of the deflection system and the EHT system is working and that, in all probability, the video stage is working at least to the point where it is allowing correct operating voltages to reach the picture tube cathode. In these circumstances we should look for a video signal fault somewhere in or ahead of

MINIBRIDGE — EX-STOCK

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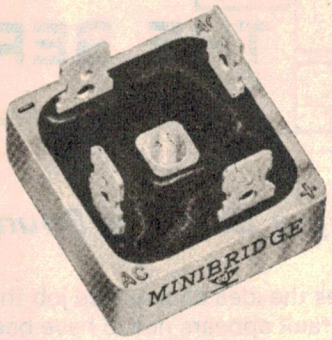

FEATURES

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Universal, 3-way terminals — snap on, wrap around, or solder
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Small size — simple installation

The MINIBRIDGE was designed to replace larger bridges or four studs in power supplies, converters, inverters, motor control circuits and DC motor starters.

25A	Type	PB40	PB60	PB80	PB100
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	PIV / leg	400V	600V	800V	1000V

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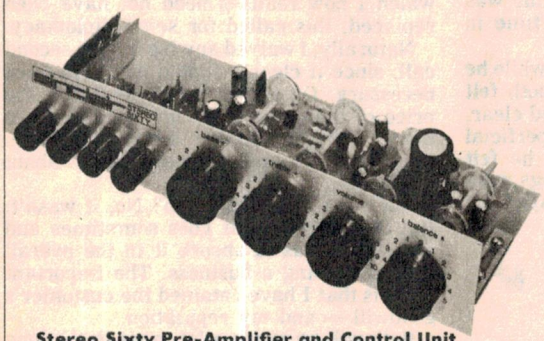
Sinclair Products for the Electronic Constructor

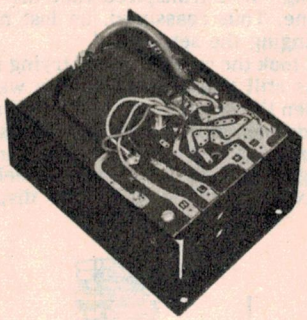
PZ.5 and PZ.6 Power Supply Units

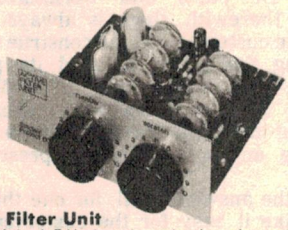
Two units available for use with Sinclair high fidelity equipment. For the majority of domestic applications the PZ.5 is adequate. Where low efficiency loudspeakers are used it will be necessary to use a PZ.6 stabilised power unit.

PZ.5—Unstabilised power supply unit; Output: 30 Volts/1.5 amps maximum —Mains input: 110-240 Volts ± 20% 50/60Hz.

PZ.6—Stabilised mains supply unit delivers 35 Volts/1.5 amps with ripple less the 20mV at any output up to maximum current.







Stereo Sixty Pre-Amplifier and Control Unit

Elegant modern design in a unit that meets the most stringent high fidelity standards. Features include:— Silicon epitaxial planar transistors used throughout; very high signal-to-noise ratio; excellent channel separation. Input selection is by means of four push buttons and accurate equalisation is provided for all the usual inputs. Tone controls are also very carefully designed and tested.

SPECIFICATIONS:
Input Sensitivities:
Radio: Up to 3mV
Magnetic pick-up: 3mV correct to R.I.A.A. curve ± 1dB 20 to 25,000Hz
Ceramic pick-up: Up to 3mV
Auxiliary: Up to 3mV
Output:
250mV
Signal-to-noise Ratio:
Better than — 70dB
Channel Matching:
Within 1dB
Tone Controls:
Treble + 15dB to — 15dB at 10kHz
Bass + 15dB to — 15dB at 100 Hz
Power Consumption:
10mA max.
Front Panel:
Brushed aluminium with black knobs and controls
Size:
8¼" x 1⅝" x 3½"

Active Filter Unit

The Sinclair A.F.U. is unique in that the cut off frequency is continuously variable for both the scratch and rumble units and, as the attenuation in the rejection band is rapid (12dB per octave), the removal of interference can be achieved with less loss of the wanted signal than has previously been possible.
The unit may be connected between the pre-amplifier and power amplifier sections of any amplifier.

SPECIFICATIONS:
Employs two Sallen & Key type active filter stages, the first being a rumble (high pass) filter and the second a scratch (low pass) filter. The two stages use complementary transistors to minimise distortion. Supply voltage 15 to 35V.
Current 3mA max. Gain at 1kHz, filters flat 0.98 (— 0.2dB)
H.F. cut off (— 3dB) variable from 28kHz to 5kHz
L.F. filter slope 12dB/octave
Distortion at 1kHz (35V supply)
0.02% at rated output (250m V.R.M.S.)
Frequency response, flat position, 35Hz to 20kHz-1dB 25Hz to 28kHz-3dB
Built, tested and guaranteed

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will outweigh criticism.

It is true that reaction to a recording, as to many other things, is highly subjective. It does not follow however, that a reviewer's reaction must be unique to himself, or narrow, or incapable of interpretation as a guide to other people's preferences. A reviewer who knows his particular field can judge fairly well what is predominantly good, or predominantly bad, or in-between.

For this reason new releases are distributed to our reviewers, according to their particular slot in the scheme of things. Julian Russell is concerned primarily with new releases of major classical works or classical recitals. Harry Tyrer looks after the re-releases, the budget classics. I do most of the devotional records. Gill Wahlquist covers the jazz and rock.

Consider devotional records, about which I can offer an opinion based on experience. My own tastes would probably be described as middle-of-the-road (did someone say middle-aged?). As such, I know that I react to recordings in much the same way as one large reader segment interested in Gospel music. If I like a particular recording, it is fairly certain that the particular reader segment will like it too.

But what about recordings by modern Gospel groups as, for example, DUST in this current issue? As music, the album brought me no listening pleasure and I am quite sure that many would share this view. But I am equally aware that there is a whole generation of younger buyers of Gospel records who are "turned on" by the rock sound. So this reviewer's approach was to warn off those likely to dislike the album but to point out that DUST was an outstanding group as judged by "mod" standards.

Again, I don't listen by choice to pure negro Gospel or to cathedral chant but I don't pan such albums on that account. Knowing that there are reader groups interested in such music, I draw attention to it, define the contents and comment on its most obvious qualities, be they good or bad. Thus informed, readers can reject the recording or follow it up, depending on their inclination.

As a reviewer, there's another whole area that I find I have to be sensitive to — that to do with recordings neither aimed at nor suitable for large scale commercial release. They may be of local artists, groups, choirs; they may involve train noises, special events or re-cuts of old recordings.

At least some of them could be criticised as artistically mediocre or technically poor or sonically uninteresting, when compared with normal commercial records selling for the same money. What one has to remember, however, is that some listeners may have a personal interest in the content which over-rides the limitations. In fact, based on such considerations, the sales figures may actually be better than for some of the poorer-selling commercial releases on the major catalogues.

The wise reviewer will acknowledge the minority audience and, while feeling duty bound to point up obvious limitations of a recording, must nevertheless concede its particular area of appeal.

All this has been prompted by questions which have come out of a long period of reviewing rather than by the letter at the head of this article.

What then about classical recordings and the evaluations, mainly by Julian Russell?

Many years ago I remember asking Julian how he kept track of the many performances of individual works, such that he could relate a recent performance to others much older. Could he rely on memory? Did he keep copious notes? Or did he replay at least segments of the older discs to provide a comparison?

No, Julian didn't trust his memory, even though he has quite exceptional powers of recall. He didn't keep copious notes and he didn't attempt the Herculean task of sampling his way through numerous past albums.

His approach, rather, has been to concentrate on the two or three preferred versions of any particular work and to use them for reference, be they old or new. If a new one doesn't measure up, it is set aside. If it does, it displaces one of the others. By thus eliminating the "seconds", his task becomes more manageable.

Against a lifetime spent with music in Australia and around the world, Julian is well qualified to debate the merits and demerits of performances and to nominate those which appear to excel for one reason or another. While individuals will certainly debate his evaluations from time to time, I think it could fairly be said that a library built on his reviews would be a good one.

Would each album qualify as "the best"? To expect that would be to expect too much. No one can set a precise value on the intangible.

In evaluating budget classics, Harry Tyrer faces a different task. The albums may be of highly rated performers but recorded some years ago. Or they may be modern recordings of lesser known performers, or modern recordings of well known performers, marked down for some other reason unconnected with either their age or their quality.

Having in mind the budget price, should a reviewer talk down a superb performance because the recording is a trifle lacking at the top end? Conversely, should he talk down a technically superb recording because it is musically somewhat below the standard of the first?

All he can do is to react in as representative a manner as possible. If it is a bargain from all points of view, he will say so. If it has good and not-so-good qualities, he will try to point them out. In the ultimate, the decision must remain with the reader, based on the weighting he attaches to price, artistic reputation, musical content and technical quality.

R.M. wonders what makes certain interpretations right or wrong. Whether reviewers are condititioned by their background and their initial introduction to a particular work.

In something as subjective as music, there are not too many absolutes. Most performers, and most conductors can find support somewhere for what they do. Our reviewers try to comment responsibly on the various types of music but they are not automatically "right" in what they say.

R.M. could do a lot worse than to regard Julian Russell as a guide and mentor in the classical field but he certainly should not feel unhappy if he finds himself disagreeing with him somewhere along the line. That might well be the sign of increasing musical maturity — something that would not be surprising in an 18-year-old student who has listened through the Ninth Symphony thirty or more times!

FORUM

Conducted by Neville Williams

Record reviewers: infallible or insidious?

How reliable are our record reviews? Do members of the reviewing panel really listen to all the albums, or do they merely read the jacket notes and say things that, in the main, will please the manufacturers? But, even if opinions are genuine, are they so subjective that they have little relevance to listeners at large?

Questions like this have been raised at times by readers and warrant an answer. If we have not provided an answer before this, it is because the matter has usually been raised as an afterthought or a postscript to more urgent technical problems. Now, however, we have to hand a thoughtful letter from a reader in St. Albans, Victoria, which prompts me to discuss the subject of reviewing at some length.

Dear Sir,

In reading your excellent magazine, and more particularly, the classical record reviews I have noted that you make comparisons between different performances of a major work. Fair enough! A comparison can help a reader choose the better version for himself.

But you often refer to a work and say that it is not strictly done: A tempo or a certain nuance is wrong; a certain tone is a bit too harsh. You say that you prefer a certain conductor to another because his technique is better.

What puzzles me is this. How do you know what the work should sound like? Is it based on your childhood or early youth listening experiences? Is music heard in early life clouding your judgement to the point where you instinctively prefer a version which approximates the first performance you heard.

I have noticed this effect in myself. About eighteen months ago I purchased a copy of Beethoven's Ninth Symphony by the Weiner Symphony orchestra under the baton of Karl Bohm. I have heard this performance perhaps thirty times in the intervening period (perhaps a record for listening to this work) and I like it. Little things about it, such as the exact tone of the baritone I now notice and enjoy.

Then I purchased an expensive copy of this work under Herbert Von Karajan. This is undoubtedly a superior work. The technique, what I can appreciate of it is undoubtedly better. The surface of the disc is much quieter. Yet I don't enjoy it as much as the earlier copy. If I were a reviewer, I would undoubtedly prefer the earlier version because of my experience.

So here is my dilemma. Is a version of a work highly rated by you really the best one available? Could I get a better copy, also reviewed by you, but not given such a highly enthusiastic mention?

Incidentally, this problem is very real for me. I am an eighteen year old radio apprentice with no musical education at all. I am engaged in building up a record library incorporating classical music and just about every performance I purchase I hear for the first time when I get it home and on my turntable. If I buy a version of a work recommended by you and it is not the best one, then I stand the chance of getting a personal bias in music the same as the one which I suspect exists in your minds. Mind you: This is not meant to be personal and I do not mean to insult any one.

I must add that it is your magazine which turned me away from that dreadful modern music and onto the classics. It is a decision which I have never regretted.

I originally read a couple of classical reviews and, intrigued by the descriptions, I purchased a copy of Holst's Planets Suite. It was an instant success and I bought classics ever after.

One puzzling thing which I notice: When I buy a major work, I usually don't like it at first playing. I need to listen to it three or four times. Then I like it and like it permanently. But, if I like a major work at the first sitting, I seem to go off it after the first couple of months and ever after cannot stand it! I do not know quite why this is but it is definitely present.

Aside from this allow me to congratulate you on an excellent magazine. One section which I would like to see expanded even more is the records section. I buy most of my discs on recommendation from your magazine and I am thoroughly satisfied with every purchase. Keep the good work going.

R.M. (St Albans, Vic)

R.M. is concerned mainly with the classical field but, as indicated earlier, I want to take the opportunity of discussing record reviewing on a wider basis.

First, let me assure anyone who needs assurance that our reviewers do listen to albums, right through, and react to the contents rather than the jacket notes.

Occasionally, when faced with a 12-record background-music set, a reviewer may elect to "sample" the tracks instead, but this is invariably stated. 12-record sets are fine for long-term enjoyment but they're a bit much to review down to every last detail!

My reading would suggest that some reviewers in other publications are rather less meticulous, and occasionally statements are made which seem to relate to the notes rather than the music. For example, one reviewer, who best remains nameless, thoroughly panned an album featuring a banjo band on the basis that any group composed purely of banjos could only (and did) sound terrible.

The flaw was that, while banjos were included in the orchestra, they certainly did not dominate what was, in fact, a quite pleasant and typical collection of evergreens. Fairly obviously, the record had never been on the reviewer's turntable!

But, back to "Electronics Australia" reviewers, of which I am one. Do we write with an ear to the music — but with an eye to the manufacturer's goodwill? Do the reviews represent an honest expression of opinion?

Basically they do — if only because a reviewer who consistently over-rates products or fails to point up obvious failings, soon loses credibility with his readers. The only practical approach is to be scrupulously fair, giving credit where credit is due, and reasons for criticism when it is offered. By and large manufacturers respect such an attitude, knowing that if their product is good, commendation

Fun has gone out of it

Dear Sir,

Electronics construction for the hobbyist appears still to be moving along a line which you justified in an editorial back in October 1970. You said then that it was more enterprising to blindly wire up integrated circuits into complicated equipment.

If that is all there is to it, why not buy the same equipment ready made?

There have been many kits available in the past with detailed instructions so that anyone with no knowledge of electronics at all could blindly "wire point A to point B" and so on. On completion it might work in a fashion or not work at all. Either way, the constructor didn't have a clue what to do.

In contrast, the real enthusiast of past days fully understood how a circuit worked. Starting with an idea or a basic circuit he would build it and get it going. Then he would juggle with component values until he felt that it could not further be improved.

All this was great fun and a challenge to his ingenuity. It seems to me that, with integrated circuits, we are all getting back to the position of the fellow blindly wiring his kit-set. As such, much of the fun has gone out of home construction.

F.K. (Hawkhurst, U.K.)

DIGITAL VOM . . . from p.39

that on the reference instrument. The preset control used to adjust the calibration of the AC ranges is the more left of the two at the rear of the top of the case.

Note that it is essential to use a sinewave signal for the AC range calibration. Do not use a square wave, sawtooth or other complex signal.

The final calibration steps are those for the resistance ranges. Here, the ideal reference to use is a precision resistance decade box of the type often found in technical college or school science labs. However, if you cannot gain access to a unit of this type, the next best thing would probably be a few selected 1pc tolerance high stability resistors.

For each of the three ranges the procedure is quite straightforward. Simply switch the DVOM to the correct range, connect the known resistor between the common and ohms terminals, and adjust the appropriate preset control. The 2M range should be calibrated first, because its calibration interacts slightly with the other two; the other two ranges may be calibrated in any order.

The preset pots used to calibrate the resistance ranges are the three at the front of the top of the instrument case. The 2M range control is that on the left, with the 20k range control centre and the 200 ohm range control at the right.

A final comment about calibration. If you have no access at all to another DVM, precision voltage source or potentiometer unit for calibration of the DC voltage ranges, perhaps the next best thing would be to obtain a mercury cell of the type used in most modern cameras having inbuilt cadmium sulphide exposure meters. When new, these cells have an open-circuit terminal voltage of 1.3566V, dropping to around 1.3524V after 12 months at an average temperature of about 21 degrees C.

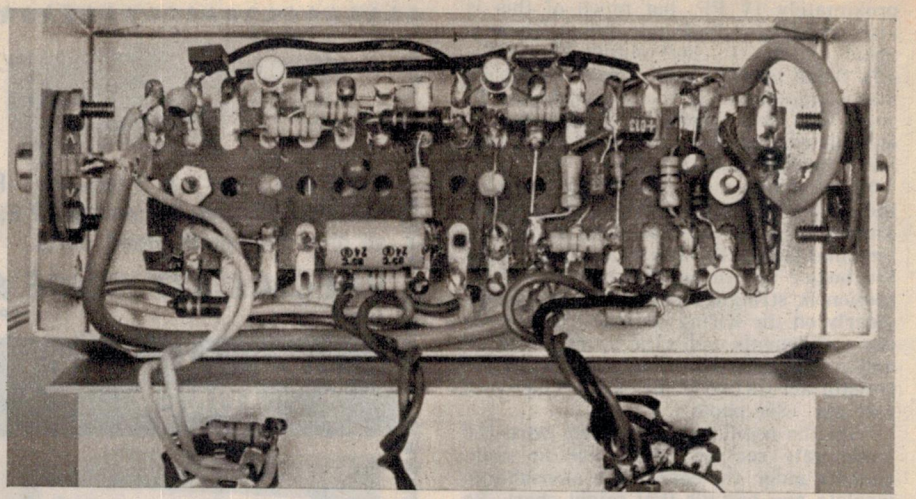
It is reasonable to assume that virtually any such cell will have an unloaded voltage of very close to 1.35V, providing it is in good condition. Even better, a cell bought as new from a large city photographic store, where it is likely to be fairly fresh, could be reasonably assumed to have an unloaded terminal voltage of 1.355V. Such cells could therefore be used to calibrate the 20V DC range of the instrument to an accuracy somewhat better than 1 per cent.

You would still have to calibrate the remaining DC and AC ranges, but it would at least be a start. Even if the other ranges were adjusted to agree with the 20V DC range and with an existing bench meter, this would perhaps suffice until you are able to gain access to a better reference.

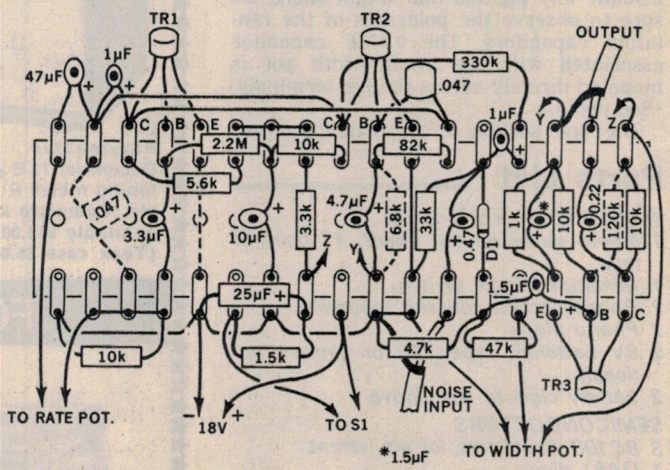
The main point to remember is that the mercury cell should be the type designed for use in photographic exposure systems, not the type designed simply as a power source for hearing aids and similar applications. This is because the photographic type is expressly designed to maintain its terminal voltage within close limits.

A suitable cell is the Eveready type EPX-13, which should be available from all photographic stores and major pharmacies.

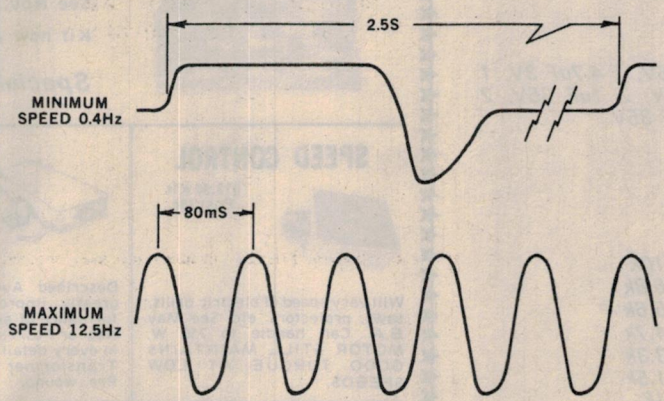
And finally, please note that the circuit diagram last month had transposed input polarity signs on the 740 input buffer IC. The wiring diagram is correct, however.



Above: Inside the complete unit. The "rate" pot is at lower left and the "width" pot at right.



Right: The wiring diagram showing all the connections. Compare with the photo above and the circuit on page 54.



OSCILLATOR OUTPUT (COLLECTOR TR2)

The multivibrator waveform changes markedly from the minimum to maximum speed, as shown by these diagrams.

amplifier. There is one component under the board, a 120k. The pigtails of all the capacitors in this section should be insulated with sleeving.

We mounted our unit in a folded aluminium box. Two sockets, one at each end, provide input for the white noise and output for the chuff signals. The board is mounted in the box on ¼in long threaded pillars.

To test the chuffer connect an 18V supply; two 9V batteries (type 216) connected in series will suffice. Next connect the output of the chuffer to the input of an amplifier.

Connect the noise output of the Train Whistle to the chuffer input, and switch both units on. With the chuff rate pot at minimum, set the chuff width pot for the optimum effect in your opinion. Slowly advance the chuff rate pot and observe whether the sound effect is realistic. Readjust the chuff width pot if the maximum chuff rate sound is not to your liking.

To decrease the minimum chuff rate increase the 47uF in the oscillator circuit, or vice versa for an increased minimum chuff rate. To decrease the maximum chuff rate, increase the 0.047uF marked with an asterisk, or vice versa for an increased maximum chuff rate.

If the output from the chuffer is too great, the emitter bypass capacitor at TR3 can be removed.

proximately 1V PP, but much of this is attenuated in the diode gate circuit. There is about 150mV PP chuff output across the 4.7k diode load resistor, which will drive many amplifiers via the pickup input. To cope with less sensitive amplifiers, an optional extra stage has been added, giving an output of about 15V PP.

The reader should now be acquainted with the circuit and ready to begin construction. The whole unit is constructed on a length of terminal board, 17 pairs of terminals long. We began by wiring the oscillator. This section is straight-forward, and is shown clearly on the wiring diagram. There are two components under the board, a .047uF and a 5.6k. Also note that there is an 18k resistor across two of the tags on the chuff rate pot. (See photo.).

With the oscillator completed, wire the diode gate section. There are no components under the board. It is advisable to insulate any pigtails that might short. Be sure to observe the polarities of the tantalum capacitors. The 0.47uF capacitor associated with the chuff width pot is mounted directly across the pot terminals. (See photo.)

The last section is a straight-forward

Parts List

1 Metal box 5 x 2¼ x 2¼
1 length miniature tag board, 17 pairs of tags.
1 Miniature toggle switch.
2 Phono sockets, chassis mounting.
2 Phono plugs
2 9V batteries, type 216 or similar (optional).
2 battery clips to suit above.

SEMICONDUCTORS
3 BC108 transistors, or equivalent.
1 OA91 diode.

CAPACITORS
Tantalum
1 47uF 6.3V, 1 10uF 25V, 1 4.7uF 3V, 1 3.3uF 3V, 2 1.5uF 3V, 2 1uF 35V, 2 0.47uF 35V, 1 0.22uF 35V.
Electrolytic
1 25uF 25V.
Polyester.
2 0.047uF 100V.

RESISTORS

1 2.2M	*4 10k*
1 330k	*1 6.8k*
1 120k	*1 5.6k*
1 82k	*1 4.7k*
1 47k	*1 3.3k*
1 33k	*1 1.5k*
1 18k	*1 1k*

1 5M log potentiometer.
1 100k A potentiometer.

MISCELLANEOUS
2 suitable knobs.
½ doz nuts, screws, washers (⅛ whitworth).
2 spacers ¼ to ⅜ inches long.
Length of shielded audio cable.
Hookup wire, solder, length of 1 mill sleeving etc.

NOTE: Resistor wattage ratings and capacitor ratings are those used for our prototype. Components with higher ratings may generally be used providing they are physically compatible. Components with lower ratings may also be used in some cases, providing the ratings are not exceeded.

A Model Train "Chuffer"

This novel sound effect simulator will add realism to model railway setups, by simulating the familiar steam train "chuff chuff" sound. The chuff rate is variable via an external control, allowing the user to synchronise the sound to the speed of the model.

Our chuffer was developed as a follow up to the Steam Whistle published in October, 1972 issue. We were not aware of any similar type of sound effects simulator, thus it was necessary to develop this unit from scratch.

Most readers will be familiar with the sounds a steam loco makes as it stands in a station. These vary, but in many cases there is a low level hiss of steam punctuated by chuffs from the Westinghouse braking system. Our chuffer can simulate this type of sound when the chuff rate control is set at minimum.

As the loco moves out of the station, the low level hiss disappears and the chuffs (now from the exhaust valves) become more frequent. At this time the duration of each chuff is short compared to the time between chuffs.

Eventually the loco reaches a constant speed and, in most cases, the chuff duration now appears to equal the time between chuffs. When the driver decides to slow down he reduces or shuts off steam to the cylinders. Thus the chuff sound may cease completely, or continue at a lower level and a decreasing rate. Appropriate manipulation can produce these effects.

The steam component for our chuffer is derived from the white noise output on the Steam Whistle. If the reader has not built this unit the noise generator and amplifier section from it could be wired on a separate tag board by following the instructions in that article.

The chuffer circuit consists of a diode gate and a modified sinewave multivibrator. The diode gate is merely a reverse biased diode which is biased on by one half cycle of the oscillator output. The output from a multivibrator can be made roughly sinusoidal by introducing certain amounts of positive and negative feedback. Our oscillator is designed so that the output waveshape changes with frequency.

At minimum chuff rate there is a short positive pulse, after which the output goes negative and then decays exponentially to zero, where it remains for several seconds. During this off time the diode gate is reverse biased, and only the most positive peaks of the white noise pass through it. This results in a faint background hiss between chuffs which, while somewhat accidental, is not out of keeping with the sound normally encountered in the vicinity of a loco.

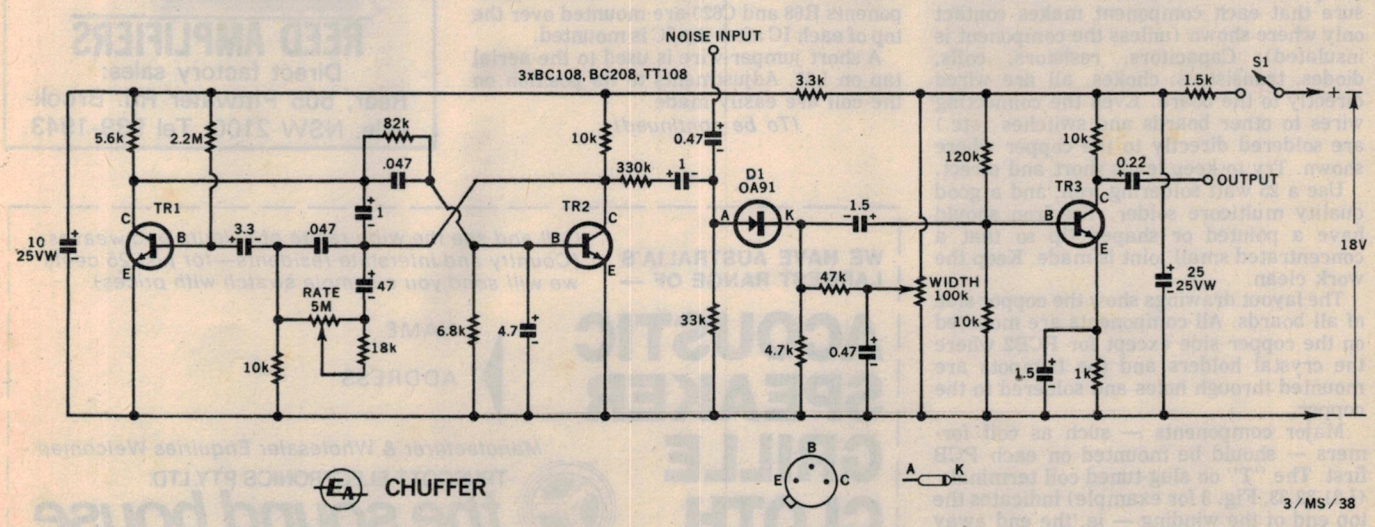
When the positive pulse recurs, the diode is forward biased to allow the maximum noise through. At minimum chuff rate our unit gave one chuff approximately every 2.5 seconds, or 24 chuffs per minute.

As the chuff rate is increased, the positive excursion of the oscillator output becomes roughly sinusoidal, while the duration of the negative excursion decreases until, at maximum chuff rate, the positive and negative excursions are approximately equal. The maximum chuff rate from our unit was approximately 12 per second.

The oscillator frequency is varied by shunting a .047uF feedback capacitor with a 47uF in series with a 5M pot. (Base circuit of TR1.) Minimum resistance gives minimum frequency.

The pot marked "Chuff Width" allows variation of the diode reverse bias, thus the diode can be made to conduct for the full duration of the positive excursion of the oscillator output, or for any portion of it. Maximum bias cuts the diode off completely.

The white noise input to our unit is ap-



The circuit is a relatively simple one. Transistors TR1 and TR2 form the multivibrator which controls the chuff rate. The rate is controlled by the 5M pot. Output from the multivibrator gates the diode D1 on and off, allowing the white noise from the "noise, input" terminal to pass through it in short bursts. Bias applied to D1 controls the period it is open and, hence, the chuff width.

9. Dry and repolish if necessary. The board should now show areas of shiny copper, exactly the same as the layout diagram. All boards are treated in the same way, and can be made singly or together as you wish.

Practice with some scraps of printed circuit board before trying the actual boards themselves!

Printed boards usually have lots of holes so that the component leads can feed through to the copper side where they are soldered to the copper. This form of construction has all the components on one side of the board and the copper on the other side and requires the board to be mounted on spacers to keep the copper side away from the chassis. Considerable simplification is possible by soldering the components directly to the copper side of the board. This eliminates hole-drilling. It also simplifies construction because it is not necessary to keep turning the board over to check connections! The board can also be mounted flat on the chassis without spacers.

drawing. In fact this does not happen because the drawing is two-dimensional and some of the symbols are much larger than the components themselves. It was a lot harder to draw than to make!

PCB3 has a shield mounted across it to separate the driver and PA stages. A piece of PCB material soldered on is ideal. A stay at one end, also soldered on, keeps it in place. Make sure that the copper connecting link running under this shield is not shorted to the shield. Filing the shield copper back where it crosses the link is a satisfactory solution.

On the receiver board, coils L61 and L62 are both fitted with a screening can. These are soldered in place. The filter is mounted upside-down against the board and held in place by stiff copper wire, soldered to its earth pins.

The IC's are mounted by forming a slight bend at the end of each individual lead. Make sure it is positioned with its indicator "notch" as shown. Make sure that you put

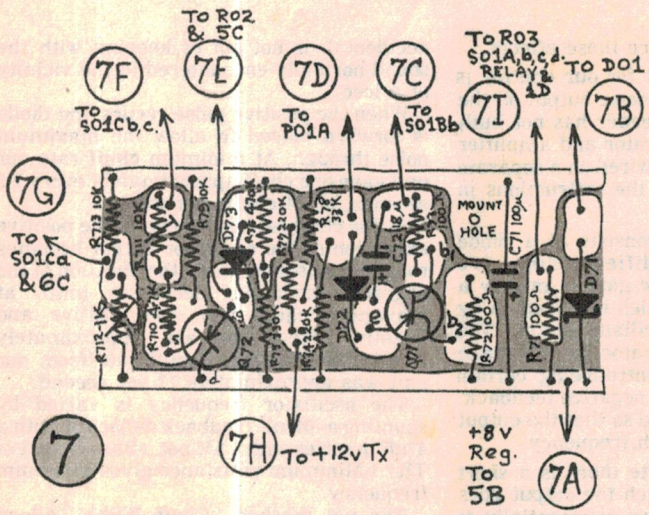


Fig. 10a. Wiring pattern and parts layout for scan and meter board. Refer Fig. 7 for associated circuits.

This form of construction makes wiring very straightforward. The components are soldered to each board where shown on the layout diagrams. Each board can be checked against the layout diagram when completed. Beware of short-circuits. Make sure that each component makes contact only where shown (unless the component is insulated). Capacitors, resistors, coils, diodes, transistors, chokes, all are wired directly to the board. Even the connecting wires to other boards and switches (etc.) are soldered directly to the copper where shown. Try to keep leads short and direct.

Use a 25 watt soldering iron, and a good quality multicore solder. The iron should have a pointed or shaped tip so that a concentrated small joint is made. Keep the work clean.

The layout drawings show the copper side of all boards. All components are mounted on the copper side except for PCB2 where the crystal holders and the trimpots are mounted through holes and soldered to the copper.

Major components — such as coil formers — should be mounted on each PCB first. The "T" on slug-tuned coil terminals (L31,32,33, Fig. 8 for example) indicates the top end of the winding — ie, the end away from the chassis.

Some congestion with components at the middle of PCB3 may be expected from the

them in the correct places — one is longer than the other. Apply very little solder to each leg. Tack one lead first, then one at the other end and get the unit properly positioned before soldering other leads. Remember — minimum solder. Components R68 and C620 are mounted over the top of each IC after the IC is mounted.

A short jumper-wire is used to the aerial tap on L41. Adjustments to its position on the coil are easily made.

(To be continued)

etched away. Ferric chloride (obtainable from chemical suppliers) is perhaps the best etchant. Use a plastic or glass dish, big enough to take the largest board. Fill with hot water from the kitchen tap. Sufficient liquid is required to cover the board. Add the ferric chloride, three or four heaped teaspoonfuls to each cup of water. Use a plastic spoon as a stirrer. Ensure that all the powder and lumps dissolve.

6. Insert the board, copper side up, making sure that it is completely immersed. Occasional agitation is desirable. The etching can take any time from 10 minutes to 2 hours depending upon the temperature and strength of the solution and the amount of copper to be removed. The "minimum etch" system has been used for these layouts, ie, only a minimum amount of copper has to be removed. Inspect frequently to check progress.

7. When all traces of exposed copper have disappeared, remove the board, wash in cold running water, and dry thoroughly.

8. Using methylated spirit, or other solvent, remove the resist to expose the copper conducting areas.

Coil Data

Two types of wire are used — 28B&S enamelled and 16B&S tinned copper. The following are wound from 28B&S enamelled on 3/16in diameter slug tuned formers:

L31	24 turns	L61	20 turns (in can)
L32	12 turns	L62	20 turns (in can)
L33	4 turns		

The following also use 28B&S enamelled

RFC31	4 turns on ferrite bead
RFC32	3 turns on ferrite bead
RFC33	3 turns on ferrite bead
RFC41	5 turns on ferrite bead
RFC34	20 turns scramble wound on ¼W resistor
RFC61	45in length scramble wound on ¼W resistor — 80 turns

Ferrite beads: Philips type 4312 020 31520 (FX 1115).

All coils using 16B&S wire (except L51) are self-supporting with turns spaced one wire diameter (except L38 and L37 which are separately noted below).

The following are wound from 16B&S over a pencil as a mandrel:

L34	5½ turns	L42	3 turns
L35	5½ turns		
L36	3 turns		
L37	2½ turns (stretched to ½in long)		
L38	4½ turns (stretched to ½in long)		
L41	3 turns (tapped halfway)		

The following coil is wound on a 3/16 inch diameter former as a mandrel:

L52 4½ turns (tapped halfway)

The frequency stability of the receiver local oscillator is dependent upon many factors. The temperature characteristics of many components will affect the stability. The stability should be such that an FM signal will stay tuned for more than an hour without tuning adjustment. Particular attention must therefore be paid to the construction of L51. This coil cannot be self-supporting because microphonics at high receiver audio levels are produced due to speaker vibrations. This effect is entirely eliminated if the coil is wound on a former. It is 4 turns of 16B&S tinned copper wire on a ¼inch diameter former (without slug). It is tapped one turn from earth end. The inductance can be adjusted by stretching its length.

R713 and the negative terminal to the junction of RO3 and RO4. SO1B connects the bottom end of the RO3 / RO4 divider to battery negative and SO1A connects the top of it to battery positive.

The other voltage divider, R712 / R713, is connected across the regulated 8V supply (D71) which remains constant for wide variations in the battery supply. The result is that, as the battery voltage decreases, the voltage at the junction RO3 / RO4 also decreases while the voltage at the junction R712 / R713 stays more-or-less constant. The meter therefore increases deflection as the battery voltage reduces.

The meter reads approximately 12.5 volts (at its zero current end) and approximately 8.0 volts at its FSD. A change of load on the battery can be made by using the press switch to bring the transmitter on. This change of battery voltage from send to receive is a very good indication of battery condition and can be used to determine battery-changing time. The setting-up method for R711, R712 and RO3 will be explained later.

If you intend to assemble this transceiver from scratch and not take advantage of a kit, then this board-making method is recommended. It affords a simple means for converting the board layouts into hardwar. Each step will be numbered so that a logical sequence can be followed.

1. Obtain the copper-clad printed-circuit board stock. PCB3, PCB4 and PCB5 should be fibreglass, but conventional board material is suitable for the other boards. Cut to the size shown for each board. Either the "sharp hacksaw and cut", or the "scriber with rule then break" method can be used. File all edges clean and square.
2. Polish the copper surface clean, using steel wool or a kitchen abrasive cleaner. Keep fingers off the freshly polished copper — handle it by the edges.
3. Place the board behind the layout diagram, copper side up. Use carbon paper and a ball-point pen and trace the shaded area outlines on to the copper (ie, ignore the components). The white areas represent the conducting areas of copper that are to be retained. Use new carbon paper.
4. You have a choice here. You can use either a "Stephens vivid black marker pen", nail polish, paint lacquer or stick-on contact paper. The aim is to cover THE COPPER AREAS TO BE RETAINED. All the areas to be retained must be covered, leaving the unwanted areas exposed. Contact paper should be stuck over the complete polished board and the layout traced on top of the paper. The copper areas to be etched away are now exposed using a sharp knife or razor blade. This work must be done carefully and with clean "edges" to ensure a craftsman-like result. If the boards have been painted they must be left until this "resist" is thoroughly dry.
5. The exposed copper areas are now to be

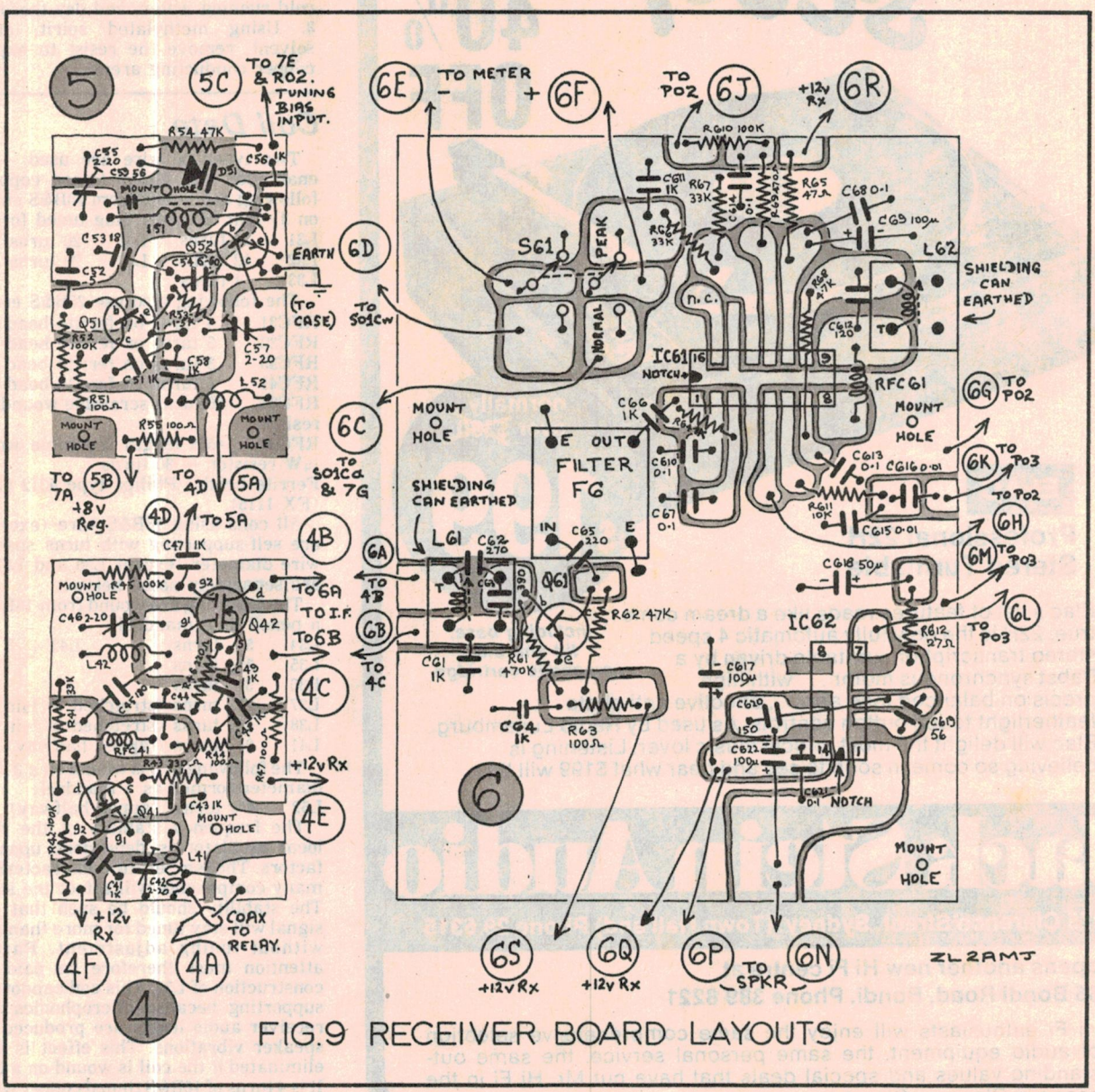


FIG.9 RECEIVER BOARD LAYOUTS

Wiring pattern and component layouts for receiver boards 4, 5 and 6. The white areas represent copper and the components are mounted on the copper side of the board, thus eliminating drilling and simplifying the placement of components. These and all other wiring patterns are shown exact size. Instructions for making these boards are included in the text.

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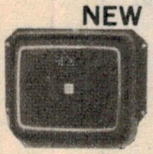

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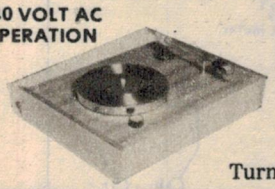

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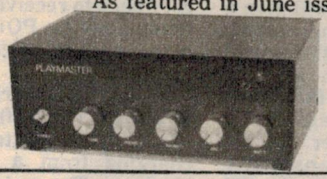

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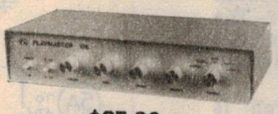

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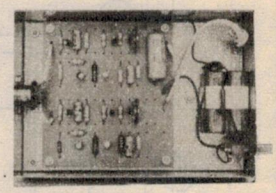

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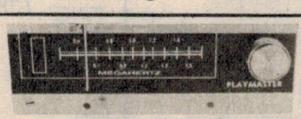

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effective bandspread. PO1B in effect causes small variations in the tuning bias line. The degree of bandspread can be selected by changing RO1 — a larger value will give a wider coverage on the fine tuning control.

In the "scan" position of SO1B the control voltage-divider chain is broken and the voltage at the junction R74 and PO1A sets the receiver frequency. The settings of PO1 now have no control whatsoever. In this mode, Q71 acts as a saw-tooth oscillator with a sweep time of about 4 seconds. C72 and R74 form the time-constant network. Ignore D72 for the moment. C72 charges and, when it reaches a pre-determined charge, Q71 conducts and discharges it. The voltage at the junction of R74 and PO1A therefore undergoes a 4 second variation of approximately the same excursion that the end-to-end travel of PO1A did previously. The meter makes a 4-second sweep of its scale with a fast fly-back, and repeats. The local oscillator simultaneously sweeps across its tuning range.

When the sweep oscillator is disabled, (ie, SO1B at "tune") C72 must be removed from the circuit to prevent lagging changes to the voltages on the main control divider chain R74, PO1A and PO1B. This is the purpose of D72 — it acts as a gate to isolate C72. The sweep time can be changed by changing C72 but 4 seconds seems to be a good compromise.

If the microphone press-switch is depressed it is essential that the meter needle always returns to its zero-current end so that a rectified sample of transmitter signal can deflect the meter in accordance with the transmitter output level. Components R77, R76 and D73 form this "return to zero" circuitry. Irrespective of the position of PO1A, when the +12V appears at the end of R77 (on transmit) the gate of the FET Q72 is taken positive via the gating-diode D73. This potential is selected to give zero current through the meter with the transmitter disabled. When the transceiver goes back to receive the meter resumes the reading set by PO1A. The transmitter RF output metering details have been covered earlier.

Resistor R75 works with D73 for another function. When first switching SO1 to "scan" the capacitor C72 has to commence charging from a completely discharged condition. The meter needle would go hard over to its stop at full-scale deflection for an instant before the scan commences. Although this happens only when the scan is first switched on, it is easy to limit the deflection by inserting R75. The meter deflection is now clamped at or near full-scale for the instant while C72 obtains its initial charge.

That completes the scan and tune circuitry. Note that in the "off" position of SO1C, the meter is short-circuited to provide meter damping. This is good practice in portable equipment.

When SO1 is in the "Bat" (d) position the meter becomes an expanded scale battery voltmeter. The meter is connected between tappings on two voltage dividers; the positive terminal to the junction of R712 and

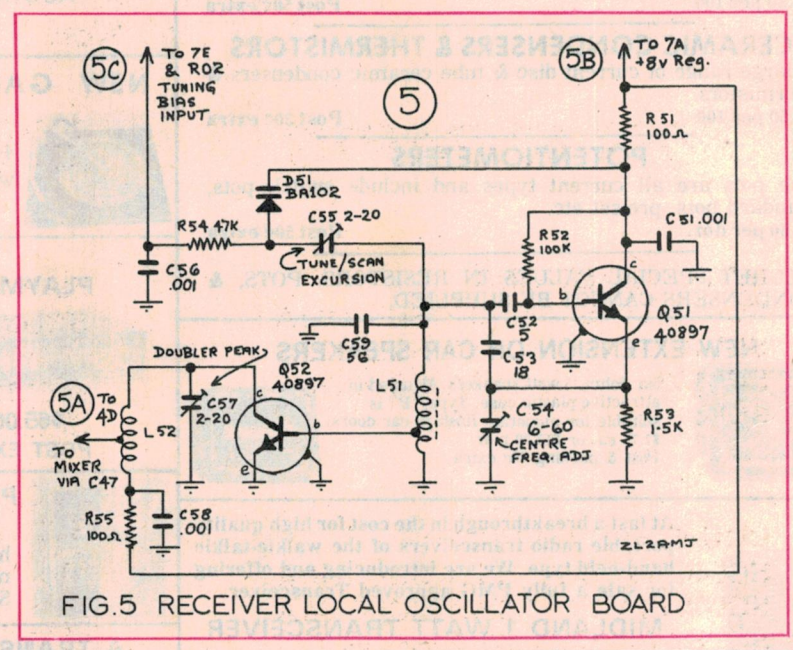

FIG.5 RECEIVER LOCAL OSCILLATOR BOARD

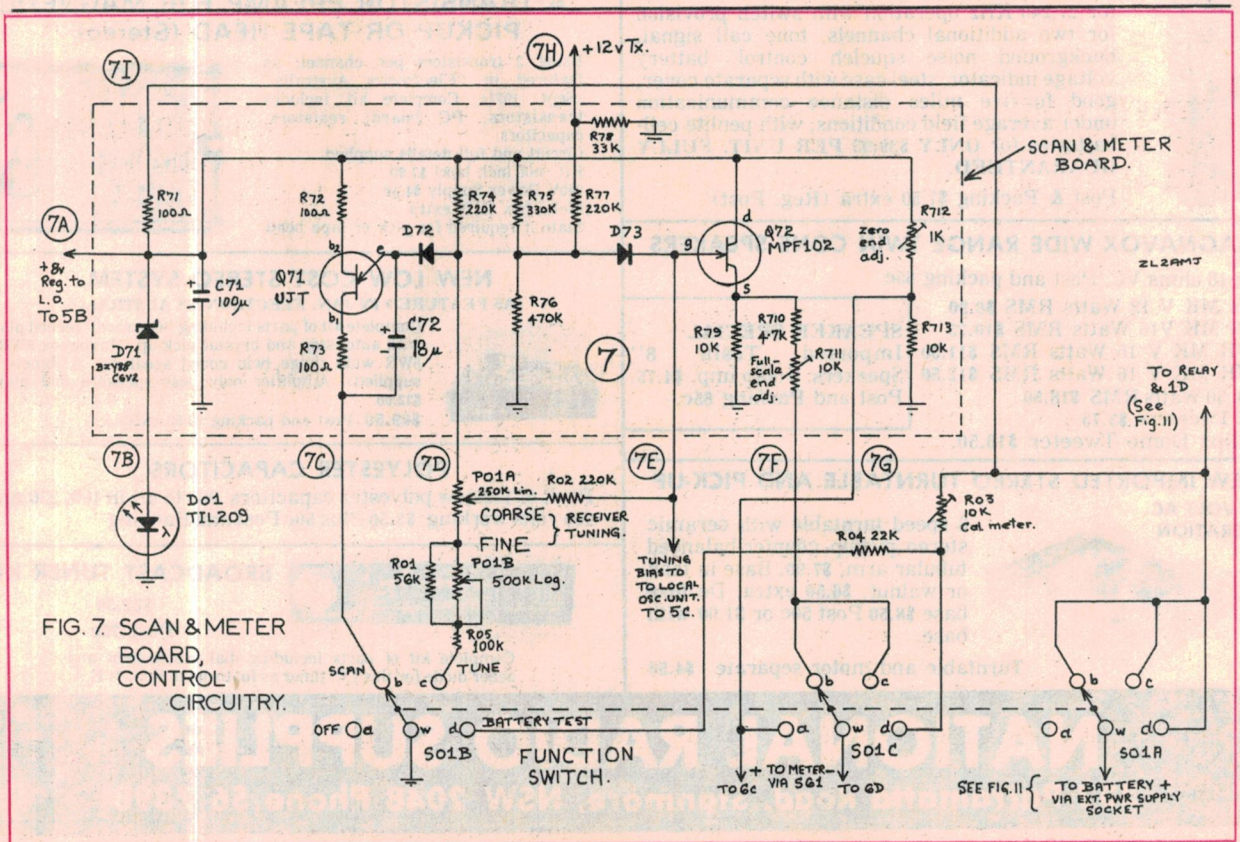

FIG. 7. SCAN & METER BOARD, CONTROL CIRCUITRY.

speakers, as indicated in Fig 4?

This leads naturally into further speculation: Musicians and producers who have hitherto exploited the interplay of instruments through left and right channels, would be able to project sounds at will from behind the listening position. From this can flow any amount of argument as to whether listeners really want to be made aware of echoes and audience noise, or be assaulted by sound from all directions.

From the domestic viewpoint, there can be obvious difficulties in having to place another two loudspeakers in the listening room and re-locate the seating. For many, the ideal of Fig 4 will be out of the question, leaving Fig 5 as the most likely compromise.

And, of course, there is a natural reluctance to spend money on extra equipment and replace existing stereo discs and tapes with new, four-channel releases. In fact, these observations are reminiscent of argument which went on during the mono / stereo transition and it seems likely that the transition from 2-channel to 4-channel will follow the same pattern.

In one sense, history has already repeated itself. Initially, it was assumed that any demand for extra channels would have to be met by the tape medium. A logical approach seemed to be to modify the existing 2-channel stereo format so that four tracks would be laid down in place of two. Ideally, such a configuration could be made compatible by arranging that the four tracks could be scanned by a four-section head structure for four-track stereo, by a two-section head to give a logical two-channel stereo output, or by a single wide-gap head to replay in mono mode. (See Fig 6.)

The logic of this approach, plus the fact that most listening rooms have four corners, set the pattern that two-channel stereo should ultimately be replaced by four-channel stereo — not by three- or five-channel.

Out of this came a variety of coined terms: quadrasonic, quadrisonic, quadsonic, quadphonic and so on. The one which seems to have gained favour is quadraphonic, mainly because it has a syllabic relationship to monophonic and stereophonic. Either that or "four-channel stereo," having in mind that stereo basically means "solid," as we have already observed.

One other word should be mentioned at this point. Since the tracks on a quadraphonic tape can be entirely independent in terms of what they contain, each potentially as important and distinct as the other, such a recording has been termed four-channel "discrete."

Efforts to market 4-channel tapes and equipment met with only limited success and, while such equipment is represented in the catalogues, it is very much a minority interest. As happened in a previous decade, it became apparent that any transition to a new system of sound reproduction would have to be effected primarily by disc equipment and in a way which would cause the least possible dislocation. The demand for 4-channel tapes would then follow as a matter of course.

Out of this situation emerged, in the short term, various schemes for simulating quadraphonic reproduction using existing 2-channel disc recordings. The basic idea was — and still is — to combine the "right" and "left" signals of a 2-channel recording out

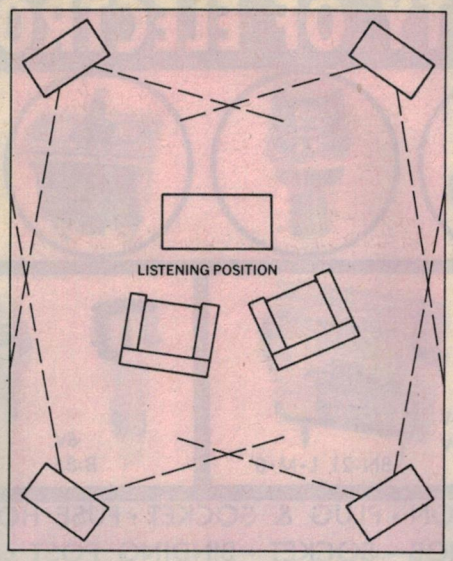

Fig. 4: Ideally the listening room for quadraphonic reproduction should be arranged like this.

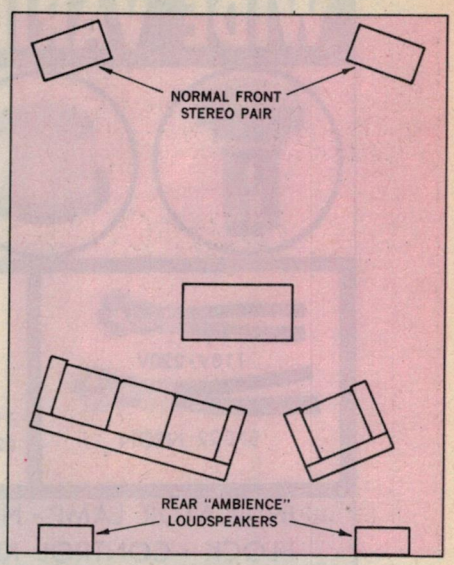

Fig. 5: To save space, small loudspeakers may be placed high up on the rear wall, as shown.

of phase, so that a "difference" signal is produced which has no counterpart in what is fed to the front loudspeakers. By feeding this difference signal to loudspeakers behind the listening position, another and distinct sound is produced which can readily be interpreted as one or more additional channels.

In orchestral recordings made originally with a single stereo microphone cluster, the difference signal tends to contain a minimum of the direct frontal information,

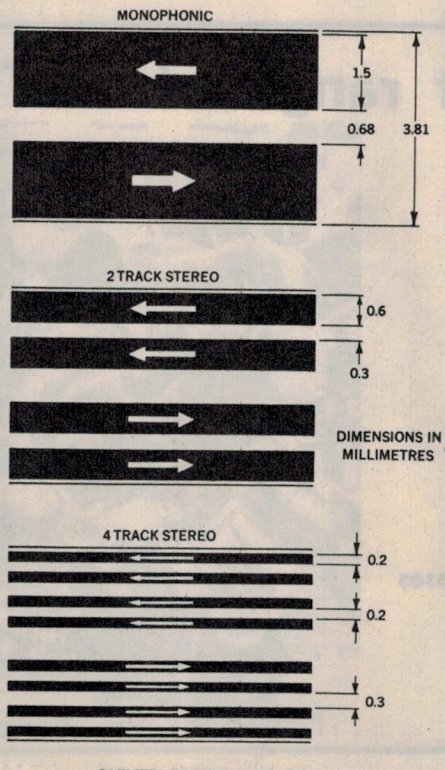

Fig. 6: Track patterns for mono, 2-track and 4-track stereo configurations on cassette tape. They are compatible but the 8-track configuration would demand critical mechanical accuracy.

because combining the two signals out of phase cancels it out. Signals from other directions, including echoes, are not cancelled to the same extent. As a result, the difference signal can provide a larger proportion of **ambience** information.

Again, where a record has been made with solo effects unique to one channel, they will appear without any significant cancellation in the difference signal, and therefore in the rear loudspeakers. The end result can be a rather accidental and sometimes startling distribution of the sound sources around the room, not very different from what might be done deliberately with a true 4-channel system.

In terms of circuitry, four channel simulation can be approached in a number of ways. The simplest is probably the system popularised by Hafler-Dynaco in America, where two additional loudspeakers, connected out of phase, are fed with a modified difference signal picked up directly from the loudspeaker outlets of an existing stereo amplifier. (See Fig 7.)

An elaboration of the idea, first introduced in Australia by AWA, introduces transformers into an add-on simulation unit, giving somewhat greater versatility in the way in which the rear loudspeakers can be interconnected.

A still further idea, popularised by "Electronics Australia" magazine, blends the right and left signals in an adaptor unit using four transistors and a few other components, producing signals which are intended to be fed to a second stereo amplifier and thence to a pair of rear loudspeakers. Though more elaborate, it gives complete control over the rear channels and can produce pleasant and convincing simulated quadraphonic reproduction.

Over and above these approaches, overseas manufacturers have produced a variety of very elaborate 4-channel synthesisers, some separate, some combined with complete amplifiers.

The concept of simulated 4-channel stereo is important in the marketing sense because it provides a vital bridge between existing 2-channel technology and equipment and what lies ahead. Audio enthusiasts can purchase supplementary equipment of one

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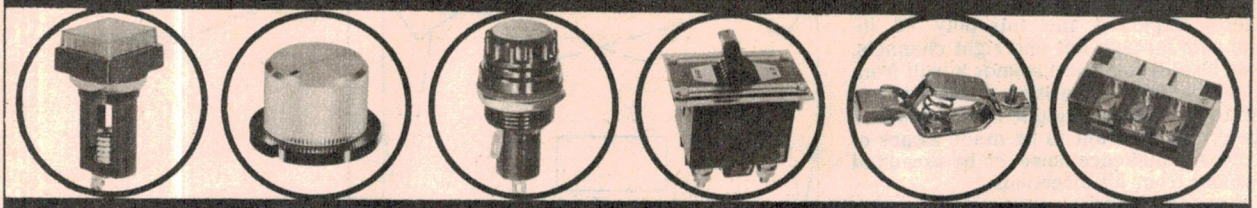

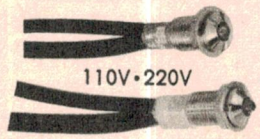

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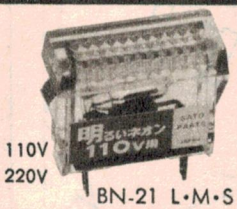

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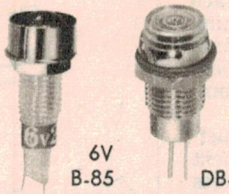

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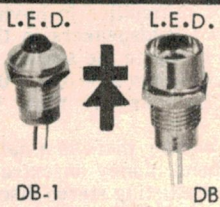

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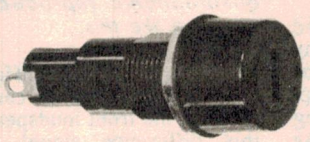

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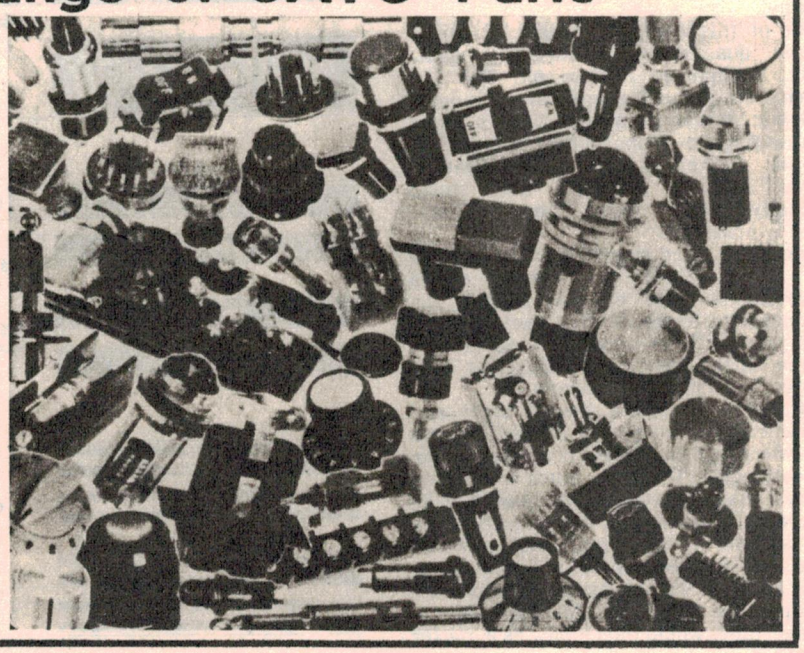

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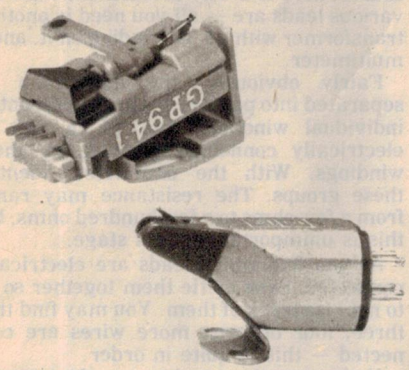
type or another, at any time they choose, and go right on playing their existing two-channel records or tapes — either in two-channel stereo or simulated quadraphonic.

But, so equipped, they are in a favourable position to play genuine 4-channel material, provided it is compatible. And from this remark flows what has been undoubtedly the greatest trauma in the hifi industry during the last decade — the problem of producing 4-channel discs which hopefully, will be compatible with 2-channel equipment and technology.

At first glance, the problem may seem incapable of solution. While a stylus may be driven in two virtually independent directions as per Fig 1, there is no obvious way for it to be driven in four independent directions, as would seemingly be necessary to produce four independent signals.

In fact, however, a partial solution has been evolved, based largely on the work of an American enthusiast-engineer-musician by the name of Peter Scheiber.



Typical stereo cartridges able to cope with mono, 2-channel stereo or 4-channel matrix. At top a ceramic type, below a magnetic cartridge.

Scheiber used a **matrix** or combining circuit (Fig 8) to merge four independent audio signals on to two channels. He showed that, by reversing the procedure, it was possible to recover four signals from the two channels. With such a system, a large amount of intermixing or **cross-talk** is inevitable, with the result that the four recovered signals differ significantly from the four originals. However, Scheiber claimed that by careful design of the **encode** and **decode** matrices, an acceptable result would be obtained.

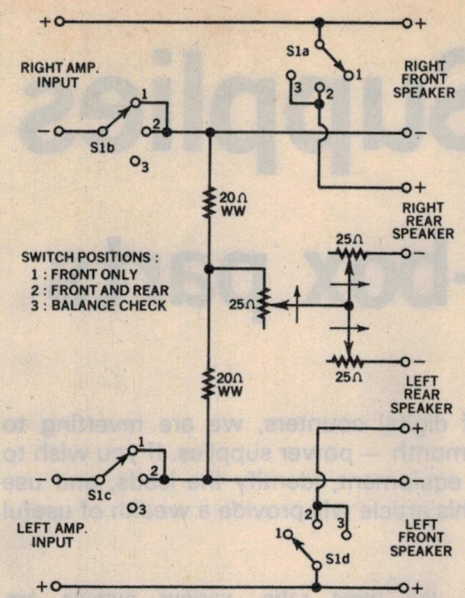


Fig 7: Circuit details of the QD-1 Quadaptor marketed by the Dynaco Company. It feeds a "difference" signal to two additional loudspeakers, without involving an additional amplifier. Considering its simplicity, it is very successful.

A vital point about Scheiber's method was that it made no new demands on existing recording and playback techniques, being equally adaptable to disc or tape recording and to stereo FM broadcasting. Encoded four-channel material could be recorded or broadcast, and recovered either as mono or stereo on existing equipment, or decoded and reproduced as a quadraphonic program.

After a period of uncertainty, audio engineers around the world addressed themselves to the matrix system and came up with quite an array of names, circuits and patents relating to their particular and favoured matrix configuration. Some of them have found common ground but there is still a great deal of rivalry between the "SQ" system favoured by Sony, CBS and EMI, the "QS" system favoured by Sansui, and "RM" (regular matrix) favoured by those who have been prepared to sink their differences.

For optimum decoding, playback equipment needs to include matrices designed for the specific systems and, in fact, many adaptors and amplifier systems now appearing on the market do have selector switches offering this facility.

How important such a facility is has yet to be proven in the marketplace. Most decoder circuits tend to produce a reasonably convincing "surround" effect from almost all encoded program material — and from a great many existing 2-channel recordings as well. The subtleties of apparent sound source position may well be more important to engineers than they are to the listening public! Some of the fervour may therefore drain out of arguments about the respective matrix systems.

One important group of manufacturers, headed by JVC-Nivico in Japan and RCA in America have adopted the attitude that the matrix system in any form is inadequate, because of its inherent cross-talk problem. They have evolved a quite different system which aims to provide four distinct (or discrete) signals from a disc record.

During recording, all the right hand signals (front + rear) are fed to the stereo cutter in the normal way and appear on one wall of the standard stereo groove. Similarly, all the left hand signals (front + rear) are inscribed on the other wall. When played back on ordinary 2-channel equipment, the record is heard in normal stereo, with normal frontal separation. In this sense, the so-called CD-4 discrete disc is completely compatible.

There is more to it, however. A difference signal is derived (front — back) for each side. These difference signals are modulated on to a high frequency carrier and the resulting band of frequencies from 20kHz to 45kHz are impressed on the groove wall, along with the main audio modulation. Ordinary 2-channel equipment simply ignores this extra information so that it does not compromise compatibility.

However, by playing a CD-4 recording with a suitably designed pickup and passing the signal through a demodulating and decoding unit, the four signals so derived can be combined to produce the four signals originally fed to the recording equipment.

The CD-4 system is technically more complex and more expensive and requires more specialised replay equipment in the home for optimum results. Its proponents claim that this is justified by results and that it avoids the compromises of the matrix method. Champions of the matrix approach take the reverse position — naturally!

Four-channel sound is undoubtedly here to stay but the consumer will be the final arbiter as to the relative popularity of program sources: tape reel, tape cartridge, tape cassette, matrix disc or discrete disc!

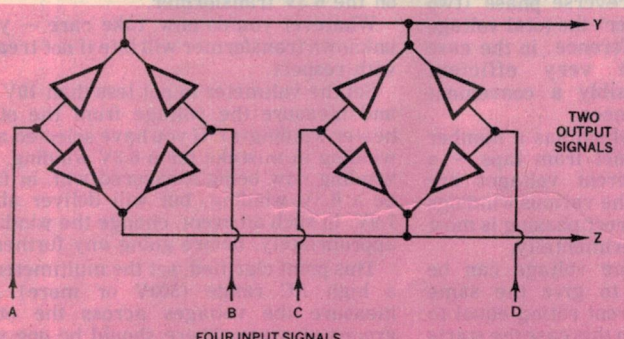


Fig 8: A basic 4:2 encoding matrix, from four channels to two channels. The proportions of A, B, C & D which appear on Y and Z depend on the gain, phase and frequency characteristics of the individual matrix amplifiers.

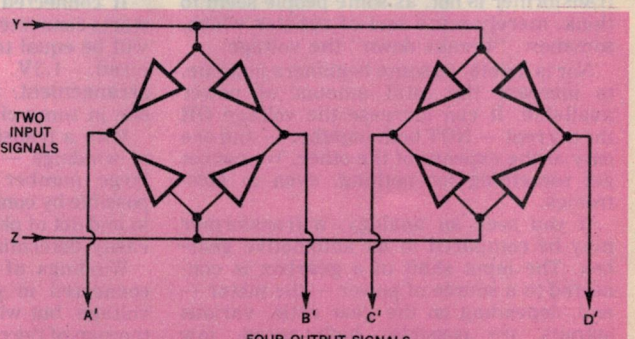


Fig 9: A 2:4 decoding matrix, from two channels to four channels. Note that the four output signals are branded as A', B', C' and D', implying that the four output signals are not identical with the original input signals A, B, C & D.

Power Supplies from junk-box parts

Elementary Electronics

by Ross Tester

As a change from the intricacies of digital counters, we are reverting to something relatively fundamental this month — power supplies. If you wish to salvage transformers from discarded equipment, identify the leads, and use them in simple power supplies, then this article will provide a wealth of useful information.

Because our domestic power supply is 240V AC, and because most modern electronic equipment requires a low voltage DC supply, we need to convert one system into the other.

Most readers would, by now, know that a transformer can be used to convert one AC voltage to another.

Transformers come in all shapes and sizes. The construction, however, is basically the same. Over a soft iron laminated core, a primary coil is wound. Over the top of this is placed a layer or so of insulation, then one, two, three or more secondary coils are wound on top. A final layer of insulation completes the transformer.

There may be a number of secondary windings, or there may be a single winding, tapped or untapped. Secondary voltages range from fractions of a volt to many thousands of volts.

For a more detailed explanation we refer to chapter 2 of our Home Study Course (July 1971). Briefly, however, transformers work on the principal of "mutual induction", where the changing magnetic field of the primary coil induces current flow in the secondary coil.

It is for this reason that transformers cannot — AND MUST NOT — be used with direct current. Connection to DC will severely damage the transformer or fuse associated circuitry.

Transformers can convert any given voltage into a higher or lower voltage. A transformer is not, as some people seem to think, merely some sort of resistor which, somehow, "breaks down" the voltage.

Nor is it able, as some beginners imagine, to increase the total amount of power available. It can increase the voltage OR the current — NOT both together — and one only at the expense of the other. We cannot get something for nothing, even in electronics.

If you seek an analogy, a transformer may be compared to an automotive gearbox. The input shaft of a gearbox is connected to a source of power — the motor — and, depending on the gear ratio, various outputs are possible: high speed, low torque; low speed, high torque; or anything in between.

A transformer works in much the same way. The primary is connected to a source of power — the mains — and, depending on the turns ratio, various outputs are possible: high voltage, low current; low voltage high current; or anything in between.

Fairly obviously, if the gear ratio in the gearbox is 1:1, the output will be the same as the input. Similarly, if a transformer ratio is 1:1, the output will be the same as the input. (Such an arrangement is not as useless as it sounds!)

Excluding losses in the transformer (which are small), the ratio of output voltage to input voltage is the same as the ratio of the primary and secondary turns. If there are 1000 turns on the primary of a 240V transformer, and 100 turns on the secondary, the output will be 24 volts.

The current we may draw from a transformer depends on a number of factors, the main one being the thickness (gauge) of wire on both the primary and secondary windings.

Suppose we have a typical transformer with, say, a couple of 6.3V windings. Can we join these together to vary the voltage or current available from the transformer?

The answer is yes, but . . .

To achieve the end result we seek, we must connect the windings together correctly or, to be technical, in the "correct phase".

If two windings are connected in series, in proper phase, (start of one winding to the finish of the other) the total voltage will be the sum of the individual voltages. A 6.3V and 5V winding in series will give 11.3V.

If connected in the reverse phase (two starts connected together) the total voltage will be equal to the difference; in the case cited, 1.3V. Not a very efficient arrangement, but possibly a convenient one in some circumstances.

With a transformer which has a number of windings — as distinct from taps — a large number of different voltages are possible by connecting the various windings in and out of phase. Correct phasing is most easily determined experimentally.

Windings of the same voltage can be connected in parallel to give the same voltage, but with a current rating equal to the sum of the ratings. In this case the starts and finishes are connected together to give the correct phase. Again, this may be determined experimentally, correct phasing being that which does not produce sparks when it is connected temporarily.

Let us assume that you have a mains transformer of unknown type. It may have come from the proverbial "junk box" or it may be attached to a chassis. If the latter close examination of the valves and transformer wiring may give a good clue to its windings.

If the transformer is from an unknown source, here is a way to work out what the various leads are — all you need is another transformer with a 6.3V winding on it, and a multimeter.

Fairly obviously, the leads can be separated into pairs or groups representing individual windings, and which will be electrically connected together by these windings. With the ohmmeter, identify these groups. The resistance may range from a few ohms to a few hundred ohms, but this is unimportant at this stage.

As you find which leads are electrically connected, twist or tie them together so as to not lose track of them. You may find that three, four or even more wires are connected — this is quite in order.

If the transformer has an electrostatic shield, one of the leads will not be connected to any other lead. Note the lead colour for future reference.

Next, try to identify a 6.3V heater winding. Heater windings are easily identified by the very much heavier wire with which they are wound but there may be no easy way to pick a 6.3V winding from the 5V one.

One hint involves centre taps. A 5V winding is not normally centre tapped, so a centre tapped winding, if there is one, is more likely to be 6.3V.

Having made the best choice you can, connect it to the 6.3V winding of the other transformer. No harm will result if you happen to have chosen a 5V winding.

Make sure that none of the ends of any wires are touching any others, and switch on the 6.3V transformer.

Whatever you do now, take care — your unknown transformer will bite if not treated with respect.

Set the voltmeter to not less than 10V AC and measure the voltage from the other heater winding(s). If you have selected a 5V winding in mistake for a 6.3V winding, the winding now being measured will, in fact, be a 6.3V winding, but will deliver about 7.9V. In such an event, change the windings appropriately, before going any further.

This point clarified, set the multimeter on a high AC range (500V or more) and measure the voltages across the other groups of wires. There should be one winding which develops close to 240V, and this is most likely the primary winding.

If more than one winding gives a reading of this order, two things will help you determine which is the primary. (1) The

colours of the primary winding are often red and black — or some group of two colours, while the secondary leads are likely to use identical colours.

(2) The primary winding may or may not have voltage taps. If the winding you think is the primary has only two leads emerging from it, the chances are that you have picked the correct winding.

If, however, the primary is tapped, and the secondary is centre-tapped, you have one more card up your sleeve. Measure the resistance between the leads on both the secondary and primary. For the secondary, the resistance between 2 pairs should be similar, and that between the third pair roughly twice this value.

The primary tappings will behave quite differently. The resistance between the common end of the winding and any of the taps will be high (say 50 ohms or more) and slightly higher for each higher voltage tapping. Between any of the taps the value will be quite low — probably 10 ohms or less.

While this system should work with most transformers you may come across, it may not work if the transformer is a very old type which was used before 6.3V became the "vogue" for heaters. In this case, it may not be wise to use the transformer anyway.

In dealing with any old transformer, take a good look at it before connecting it to power. Run your hands along the wire. If the insulation appears brittle — or non-existent near the transformer core, discard it. Such a transformer is simply not worth the risk it entails.

Similarly, if the insulation around the core, or the core itself, appears damaged or poor, discard it. Only transformers which are in obviously good condition should be used. It is hard to put any age limit on useable transformers, but I would hesitate to use anything over, say, twenty years old.

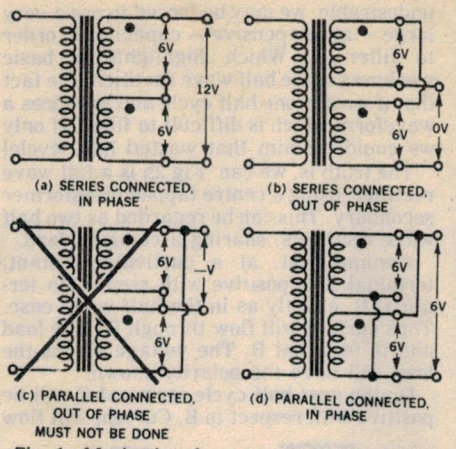


Fig 1. Methods of connecting transformer windings in series and parallel to provide higher voltage or current capability. The dot is the symbol for start of winding.

If you are satisfied that the transformer is safe, and you have positively identified the primary winding, the mains supply may be connected to it, via a fuse of around 1-2 amps. Then all the other windings can be accurately measured with the multimeter.

Once the voltages are identified, we can use them in a number of ways. Some things (lamps, valve heaters, etc) can use AC. So, providing the voltage is correct, we can use the output directly from the transformer.

However, for the vast majority of electronic equipment, DC is required, so we must convert the AC to DC. We do this, in part by means of a rectifier.

While there are a large number of rectifying devices available, the almost universal device today is the silicon diode.

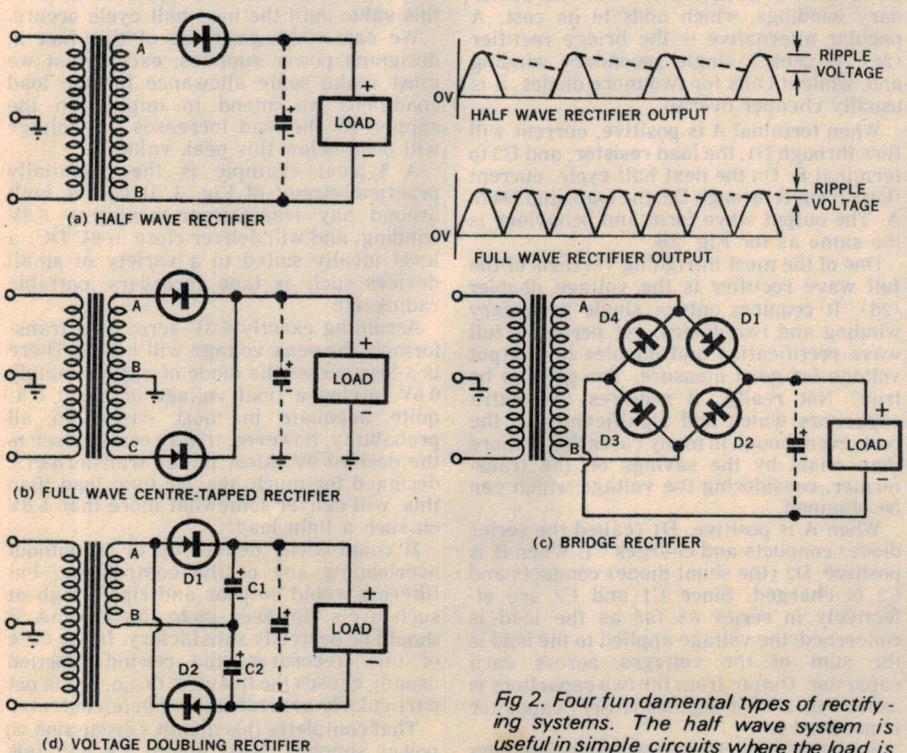


Fig 2. Four fundamental types of rectifying systems. The half wave system is useful in simple circuits where the load is light and the cost of a more complex arrangement cannot be justified.

It is cheap, rugged, efficient, and lends itself readily to almost any of the various rectifying circuits which are possible.

This variety of rectifying circuits may confuse the beginner, who is tempted to ask, "Which is best?" In fact, there is no "best"; only a circuit best suited to a particular job. Let us look at some typical arrangements.

The simplest is the half wave rectifier (2a). If we assume that, at a particular instant, terminal A is positive and terminal B negative the diode will be forward biased and conduct. Current (conventional) will flow from A, through the diode, through the load, to B and through the transformer winding to A. The voltage across the load will have the polarity shown.

A moment later, on the next half cycle, terminal A will be negative, and B positive. The diode will be reverse biassed and no current will flow. Thus the output from this circuit will be a series of half cycle bursts, all of the same polarity, but spaced apart by a period equal to one half cycle. See waveform adjacent to 2a.

Such an output is not true DC. While it does not reverse its polarity, neither is it a smooth supply. It would be useless in the majority of applications.

This is the reason for the capacitor, shown dotted. During the conducting half cycle the capacitor is charged and, if it is large enough, will store enough energy to maintain the voltage across the load during the idle half cycle. Its behaviour is shown as a dotted line, like a shallow saw tooth, along the tops of the half wave pulses. The slight downward slope represents the rate at which the load discharges it.

Since even this amount of ripple may be undesirable, we may be forced to use a very large — and expensive — capacitor in order to filter it. Which highlights a basic weakness of the half wave rectifier; the fact that it wastes one half cycle and produces a waveform which is difficult to filter. If only we could reclaim that wasted half cycle!

The truth is, we can. Fig 2b is a full wave rectifier, using a centre tapped transformer secondary. This can be regarded as two half wave rectifiers, sharing a common load.

Assume that, at a particular instant, terminal A is positive with respect to terminal B, exactly as in the half wave case. Thus current will flow through D1, the load and to terminal B. The voltage across the load will have the polarity shown.

On the next half cycle terminal C will be positive with respect to B. Current will flow through D2, through the load, and back to B. The polarity across the load will be the same as on the previous half cycle. The wave form is adjacent to this circuit.

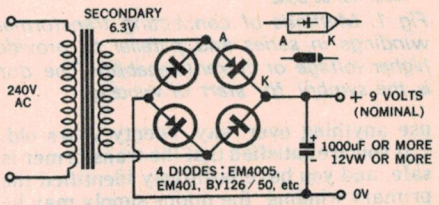


Fig 3. A simple power supply for small solid state devices. Note that proper precautions should be taken with regard to mains leads and transformer connections.

Again, we have shown the behaviour of the filter capacitor as a dotted line, and having the same slope. Note that the ripple is very much less with this arrangement.

The centre tapped transformer circuit is not the only full wave arrangement. Its major disadvantage is that it requires what is, in fact, a transformer with two secondary windings, which adds to its cost. A popular alternative is the bridge rectifier (2c). It uses a single secondary winding and, while it calls for two more diodes, it is usually cheaper overall.

When terminal A is positive, current will flow through D1, the load resistor, and D3 to terminal B. On the next half cycle, current flows from B through D2, the load, and D4 to A. The output wave form and behaviour is the same as for Fig. 2B.

One of the most intriguing versions of the full wave rectifier is the voltage doubler (2d). It requires only a single secondary winding and two diodes, yet performs full wave rectification and doubles the output voltage for good measure. Too good to be true? Not really; it requires two extra capacitors which add significantly to the cost, even though in many cases this is more than offset by the savings on the transformer, considering the voltage which can be obtained.

When A is positive, D1 (called the series diode) conducts and charges C1. When B is positive, D2 (the shunt diode) conducts and C2 is charged. Since C1 and C2 are effectively in series as far as the load is concerned, the voltage applied to the load is the sum of the voltages across each capacitor. Output from the two capacitors is as for Fig. 2b and another (filter) capacitor is necessary.

Something which puzzles many beginners when studying or building power supplies is that, putting aside such tricks as the voltage doubler, they still seem to deliver more voltage than the rating of the transformer would suggest was possible.

For example, consider the simple circuit of Fig. 2a. If the transformer secondary winding developed 50V and the supply was working into either no load, or a very light load, we would find that the voltage across the filter capacitor would be slightly more than 70V! Why? Where did the extra 20V come from?

The answer is all tied up with such things as RMS voltages, peak voltages, and so on. It can be a long and quite complex story, but we will try to explain it in a few words.

When we refer to alternating voltages we imply, by custom, that we mean RMS (Root Mean Square) voltage. Since an alternating voltage is continually changing, there is the problem of deciding just what value to assign it.

In fact we assign a figure on a "work value" basis. This is the value of DC voltage which would be required to perform the same work if applied to a resistive load, say a lamp or heating element. Thus, 240V DC and 240V AC RMS, would both produce the same heat from identical radiators.

Since an alternating voltage is actually zero at one part of its cycle, it will obviously have to be more than its RMS value at some other part of the cycle, to make up for this. As it works out, it will have a peak value 1.414 times its RMS value. Thus, 240V RMS will have a peak value of 340; 50V RMS will have a peak of 70.

Conversely, the RMS value is .707 times the peak value. These relationships are valid only for sine wave conditions, but are close enough for most commercial supply waveforms.

Coming back to our power supply, it is easy to appreciate that the filter capacitor will be charged to the peak voltage value each time the diode conducts and, if it is only lightly loaded, will maintain most of this value until the next half cycle occurs.

We can make good use of this fact in designing power supplies, except that we must make some allowance for the load conditions we intend to impose on the supply. As the load increases the voltage will drop below this peak value.

A typical example is the essentially practical circuit of Fig. 3. It can be built around any transformer having a 6.3V winding, and will deliver close to 9V DC; a level ideally suited to a variety of small devices such as tape recorders, portable radios, etc.

Assuming exactly 6.3V across the transformer, the peak voltage will be 8.9. There is a loss across the diode of approximately 0.6V, giving a final voltage of about 8.3; quite adequate in most cases. In all probability, however, it may come closer to the desired 9V. Most power transformers, designed for much heavier total load than this, will deliver somewhat more than 6.3V on such a light load.

It could easily deliver up to 1A without overloading any of the components, but filtering would be poor and ripple high at such levels. However, up to about 200mA, it should be perfectly satisfactory. In the case of tape recorders, the rewind function usually causes the heaviest drain, but is not particularly critical as to ripple content.

That completes this month's discussion on power supplies. Next month we will talk about methods of voltage regulation, and how to build a simple regulated supply.

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LINTON 2.

Size: 19" x 10" x 9½"./Frequency response: 55-17,000 Hz. ± 3 dB./Power rating: 20 watts DIN./Speaker complement: 8" bass, 2" tweeter./Crossover frequency: 1,200 Hz./Finish: Oiled teak or polished walnut.

LINTON 3.

Size: 19" x 10" x 9½"./Frequency response: 55-17,000 Hz. ± 3 dB./Power rating: 25 watts DIN./Speaker complement: 8" bass, 4" mid-range, 2" tweeter./Crossover frequencies: 1,100 and 4,000 Hz./Finish: Oiled teak or polished walnut.

DENTON 3.

Size: 14" x 9¾" x 8¾"./Frequency response: 65-17,000 Hz. ± 3 dB./Power rating: 25 watts DIN./Speaker complement: 8" bass, 4" mid-range, 2" tweeter./Crossover frequencies: 1,100 and 4,000 Hz./Finish: Oiled teak or polished walnut.

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CLASSICAL RECORDINGS

Reviewed by Julian Russell

Mefistofele — "very beautiful music"

BOITO — Mefistofele. Complete Opera. Cesare Siepi (Mephisto); Mario del Monaco (Faust); Renata Tebaldi (Margherita); Lucia Danielli (Martha); Piero di Palma (Wagner); Floriana Cavalli (Helen of Troy); Lucia Danielli (Pantalis); Piero di Palma (Nereo). Chorus and Orchestra of the St. Cecilia Academy, Rome, conducted by Tullio Serafin. World Record Club Stereo S/5167/8/9. Three discs in box with libretto.

The Faust legend has attracted more attention among composers than any other of the same kind that I can recall. Wagner, Liszt, Gounod, Berlioz, and Boito, the composer of Mefistofele, the opera under review are the first to come to mind, though there are others. But to the general public, at any rate, Faust, in musical terms, means Gounod's. But Gounod's librettists dealt with only one aspect of the legend — the guilty love affair between Faust and Margarita encouraged by Mephisto, who, in the process, restores the old Faust's still remembered youth in exchange for his immortal soul.

Boito, on the other hand, who was a poet as well as a composer — you may recall that he supplied Verdi with the librettos for his last operas, Otello and Falstaff — wrote his own libretto for Mefistofele and, in doing so, tried to incorporate into his play more than the incident mentioned above. He sought to include more Goethean philosophy into his script though, by doing so he seems to have divided the work into two parts running, so to speak concurrently. The Gounod love story is there, easily recognisable in most of its aspects. But to this have been added scenes which advertise Mephisto's scant respect for God, sometimes patronising — "From time to time I like to see the Old Man" he tells some of the angels — sometimes outrageously rude, and at others purely provocative. And when he wants to show his most extreme displeasure, he whistles piercingly through his fingers like a street urchin. He and Faust make a few remarks, borrowed and simplified from Goethe, about life, death, and mankind, and Boito added another dimension to the love life of Faust — an affair, on first sight, with Helen of Troy.

I have mentioned all this because those unfamilar with the Boito opera but interested in acquiring a set of these recordings, should not expect the old Gounod-type treatment of story and music. Although the version under review was originally issued by Decca back in 1959 it never came my way and every time I have had to refer to the opera I have had to use the old HMV set. issued in 1956, with conductor Gui and Boris Christoff as Mephisto. An ironical juxtaposition of names these last two. The HMV set by the way, was on four sides, the one under review on six because extra scenes have been added, including the Helen of Troy sequence which was omitted from HMV's together, with pretty savage cutting elsewhere.

Boito was only 26 when the opera was first produced at La Scala, Milan, where it lasted for over six hours and was a ghastly flop. The scoring was amateurish and had been hurriedly completed to meet a first night date. But after later cutting and rescoring the work was presented again, more successfully this time, at any rate in Italy. I think it fair to say that it has gained respect, but not popularity outside Italy. This is a pity because the opera, in the final version recorded here, has much going for it. True, some of it is run of the mill Italian romantic opera of the mid-19th century and judged even by this standard is certainly good of its kind.

But it has features that distinguish it from any other operas of that period. There are moments of most enterprising originality, the scoring is first rate, the characters are drawn in musical terms with the firmest imaginable draftsmanship. The choral writing, too, is highly imaginative. Listen, in the "heavenly" Prologue, to the way the Cherubim flutter past — "a swarm of bees" Mephisto calls them. And listen, too, to the way Boito combines his many divisions of his choruses both here, and in the superb climax with which the opera ends.

I could go on writing a great deal more in praise of this most unusual opera but have already used more space than I had intended. I must therefore break off a little abruptly by saying that the sound on this WRC set is very good indeed considering the age of the original. The balance between voices and orchestra is always in first class balance, the musical perspectives are imaginatively handled with a sense of space everywhere that certainly goes a long way towards establishing an illusion of musical theatre. Serafin's conducting makes a generous contribution to the success of the whole enterprise. Tebaldi is a moving Margarita, her lovely voice in full bloom and never under less than perfect control. Siepi is a perceptive Mephisto, singing well, and having himself a whale of a time frolicking in the role. The only singer I found disappointing was Monaco. True his musical manners are better than usual in these unfamiliar surroundings. There are indeed moments when Serafin has obviously laboured hard to make him sound subtle. But this quality soon deserts his performance so that, despite his undeniably magnificent voice, he uses it with the worst of the vulgarities of Italian tenors, and at times, most of the time, in fact, bellows like a bookmaker.

But don't let this put you off acquiring this set if you are looking for something out of the ordinary in the way of opera. Despite its many naivities, it offers long sequences of very beautiful music and much originality in scoring and chorus writing. If you have a friend who has a set, get him to play you the end of the prologue and the epilogue.I don't think you'll need hear any more to make up your mind.

★ ★ ★

SCHUBERT — Symphony No. 8 in B Minor (Unfinished). Vienna Philharmonic Orchestra conducted by Josef Krips.
BEETHOVEN — Symphony No. 8 in F Major. Vienna Philharmonic Orchestra conducted by Claudio Abbado. Decca Stereo SXLA6549.

Although I usually find great enjoyment in most of Josef Krips' work I must confess to disappointment with his reading of the "Unfinished." For instance, after the sombre bars of the introduction to the first movement Krips sets a very easy going pace, almost lackadaisical. It is all very sweet and relaxed, even the tutti interjections. Occasionally, during the working out section, the mood grows more vivid but Krips soon returns to his former gait.

Although, to me, Krips and the VPO are not at their best it would be unthinkable that even at this level some glorious sounds did not emerge, especially from the strings. And Krips feels — and communicates — a memorable thrill out of that marvellous development of the first theme that comes about two-thirds through the movement. There are, too, moments of mystery, a mystery soon cleared up, so that it all reminded me of someone searching Vienna in the dark and at last succeeding in finding — Demel's superb pastry shop.

Krips treatment of the first subject of the next movement makes it sound almost liturgical, the woodwind all too reminiscent of a heavenly choir. But against this you have, in the next theme, the beautifully shaded accompaniment to the lovely clarinet solo. The movement has, too, its moments of grandeur, its thrusts of drama. I readily admit that you might well disagree violently with me, especially if you happen to be Viennese. And I also admit that Schubert was Viennese, so, too I believe is Krips, the orchestra is Viennese, and the "Unfinished" is a thoroughly Viennese symphony. So what am I complaining about? Frankly I'm hanged if I know, but I do know there are performances, despite the many merits of this one, that appeal to me a deal more.

Beethoven's Eighth is one of the lighter of the nine symphonies. But in Abbado's account there are bars in the first movement in which the composer sounds almost frivolous. This mood comes later, towards the end of the symphony. But here it tends to trivialise. Some of the woodwind conversations sound truly jocular, and that's fine. But what I miss most in this performance is a tightness of line so necessary, not only here, but elsewhere in the presentation of Beethoven's music. The second movement is fascinating. The accompaniment figure beats metronomically — as it was intended to do — but over it the melody dances with the grace of a sylphide. It should take you a long time to tire of it.

The minuet theme is given a large

CLASSICAL RECORDS

statement but to me, it lacks majesty, real or parodied. And some smudgy horn playing in the trio quite obscures the daintily played accompaniment. The high spirited finale goes merrily enough, full of guffaws and belly laughs with, for good measure, now and again a hefty dig in the ribs to remind you to appreciate all this wit.

Another feature this disc has to recommend it, despite what many of you might well describe as my quibbling, is the novelty of the coupling. This might well provide a deciding factor in its purchase.

★ ★ ★

GLIERE — Excerpts from the ballet The Red Poppy. Bolshoi Theatre Orchestra conducted by Yuri Fayer. EMI / Melodiya Stereo OASD 7566.

The titles of the excerpts from this ballet will give some idea of its propaganda nature — Triumphal Dance of the Coolies, Russian Sailors' Dance and so on. It so happens that the story of the love of a Chinese girl for a Soviet sea captain, whose life she saves, seems a bit unlikely in the present day Sino-Soviet political climate. Gliere, who died in 1956, had very little to say that was original, though everything he wrote was expertly put together. If you're looking for something unquestionably tuneful this should entertain you. And it is all very well if not very subtly played. Some of the melodies have a little distinction, others are mawkish or mediocre. I feel that most of it comes into the domain of my colleagues who review the lighter type of music — but I must confess that I found myself liking quite a lot of it!

★ ★ ★

ELGAR — Enigma Variations.
VAUGHAN WILLIAMS — English Folk Song Suite. Fantasia on "Greensleeves." London Symphony Orchestra conducted by Sir Adrian Boult. EMI Stereo OASD2750.

It is good to have a new recording of these wonderful variations, as moving to hear today as they must have been when they were first played. The inevitable comparison of Boult with Barbirolli is very difficult to make. To simplify matters dangerously it could be said that Barbirolli's reading is more romantic than Boult's. But that gives the impression that Boult is not romantic, which is far from the truth. Does Boult make the work sound bigger? No. I can perhaps help explain things by talking about something quite different.

In the old days during Beecham's lifetime I often attended his rehearsals. It was not unusual for him to rehearse a Delius work almost bar by bar until one could have sworn no improvement was possible. Yet when it came to the concert he would play it with many differences — and it would again sound perfect and unarguably right. I hope that helps. There is no room here for a variation by variation description of each conductor's idiosyncracies. I can only say that if you insist on a careful choice, which of two you will prefer will be solely up you. The little Vaughan Williams fills are well

enough played and recorded though I might draw your attention to the really fine swagger in the two marches of the Folk Song Suite. These small works precede the Enigma on Side 1. I am tempted to suspect that the fills were carefully timed so that the turnover in the middle of the Enigma was made to happen immediately after the electrifying account of "Troyte" and, while this marvellous sound still remained in the listeners' ears.

Considerations of space make it imperative that I hold over until next month a review of Philips' superb five-disc set of Monteverdi's books eight, nine and 10 0f his late madrigals and other compositions. To dismiss it in a few lines would be, I feel, quite unworthy of the excellence of the production.

★ ★ ★

MASCAGNI — Cavalleria Rusticano. Complete Opera. Giulietta Simionato (Santuzza); Mario del Monaco (Turiddu); Anna di Stasio (Lucia); Cornell Macneil (Alfio); Ana Raquel Satre (Lola). Chorus and Orchestra of the St. Cecilia Academy of Rome conducted by Tullio Serafin.

LEONCAVALLO — I Pagliacci. Complete Opera. Mario del Monaco (Canio); Gabriella Tucci (Nedda); Cornell Macneil (Tonio); Piero de Palma (Beppe); Renato Capecchi (Silvio). Orchestra and Chorus as above conducted by Francesco Molinari-Pradelli. World Record Club Stereo S 5148 9 50. Three discs in box with libretto.

Although I am going to mention first the shortcomings of this set of the famous operatic twins, it offers a very good bargain indeed at its club members' price. In the first place the sound is acceptable, even by modern standards. And, so far as I can recall or discover, no better performance of either of these old timers has recorded since. They were originally issued some 12 years ago. I'll deal with Cavalleria first. Serafin, who in my opinion is very greatly responsible for the success of the performance, gives the music a dignity I never suspected it had — and I have been listening to it for the best part of a by no means short lifetime. Some critics might accuse him of slow tempos which lend the music a false stateliness. I can only say that Serafin's tempos give the music time to breathe and the singers the opportunity to inject a little subtlety into their roles. True this is sometimes wasted on such a dedicated yeller as Del Monaco, but even he shows better taste than he did 10 years earlier.

Next in the recording's favour is the excellent balance between singers and orchestra. The gradual approach of the girls' chorus from back stage to footlights is admirably handled. True, there are a few bars where chorus and orchestra momentarily desert each other in Alfio's aria, but they lose no time getting back into step. As Alfio, Cornell Macneil is vocally efficient but dramatically splendid. Even out of view, as he must be when heard on a recording, he still seems able to register his character's thoughts. Simionata's Santuzza is sung with passion and plenty of black drama. In her you have complete identification with the role, which might explain the slight pulse that here and there mars the steadiness of her production.

As a rule, the part of Lola seems always to be given to someone who can do little better than appear provocative on the stage. In this set she is very well sung and characterised for a change. Ana Raquel Satre is the best Lola I can recall ever having heard.

This set was made in the early days of stereo when vivid stage effects were transferred with perhaps a little too much enthusiasm to discs. Somehow that doesn't seem to matter with Cavalleria where the violence of the melodrama is unsullied by such trivial exaggerations. At a guess I'd say that, taken all round, the vocal performances do not quite live up to the expectations of the conductor, whose care about his contribution is very obvious indeed. But it's a fine show for all that, and one, I'm sure, will have a long life in the catalogues.

In Pagliacci the company is substantially the same, the chief exceptions being the conductor, Molinari-Pradelli, and the prima donna, Gabriella Tucci. On the whole the performance is good, though I prefer Cavalleria as a production. Del Monaco indulges in his usual excesses but there is more room for them in a part as showy as Canio's. His consort, Tucci, has some good high notes — you may remember her in Australia with an overseas opera company some years ago — but is little more than acceptable in her other registers. Her vocal acting also leaves something to be desired. In the small part of Beppe newcomer Piero de Palma sings his serenade affably except for a strange note at the end. Capecchi, always to be relied upon, makes a suitably ardent Silvio. What I wrote above about Macneil's Alfio might well be repeated about his Tonio. He certainly holds his own against much very spirited singing.

Some of the orchestral playing is really tip top and the vocal-orchestral balance taken good care of. The chorus, all things considered shows more lustre in the sopranos than elsewhere but the conductor pulls everything together creditably enough.

★ ★ ★

VAUGHAN WILLIAMS — Symphony No. 5 in D Major. Philharmonia Orchestra conducted by Sir John Barbirolli. Fantasia on a Theme by Thomas Tallis. Sinfonia of London conducted by Sir John Barbirolli. HMV Stereo OASD2698.

Much as I admire most of the late John Barbirolli's conducting, when it comes to Vaughan Williams Boult is my man. And I was never made feel more certain on this point than by the Barbirolli / Vaughan Williams Fifth Symphony. The work itself is noble, one of the finest of the latter day romantic symphonies. But Barbirolli's self-indulgence in the matter of interpretation is overdoing things. Despite the admirable playing of the Philharmonia and the genuine passion that Barbirolli injects into his reading, my general response was one of disappointment. I much prefer Barbirolli in the Tallis Fantasia in which he uses the Sinfonia of London. This is indeed a lovely performance in every way, my only minor criticism being that the second orchestra is recorded a wee bit too far away to achieve the antiphonal effect intended by the composer. Otherwise only the greedy would hope for better.

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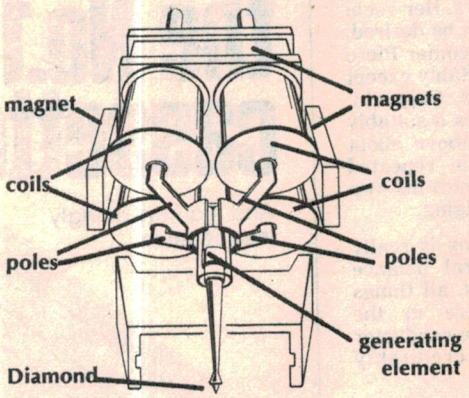

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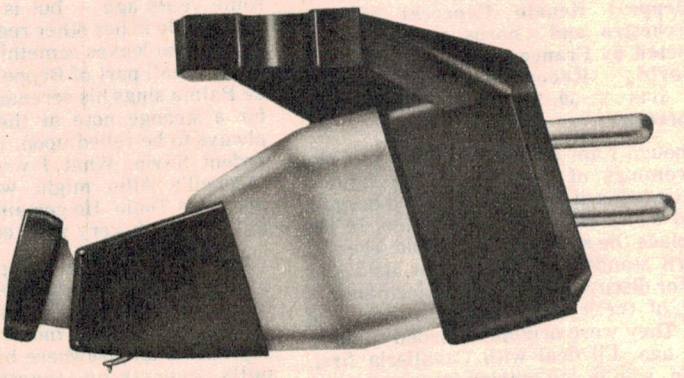

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REVIEWS OF OTHER RECORDINGS

Devotional Records

FAVOURITE HYMNS AROUND THE WORLD. The Michael John Chorale. Soloists Pat Whitmore, Michael John. Organist Ronnie Price. Stereo MAM-AS 1006 (E.M.I.)

It is difficult to imagine a devotional recording more conventional or more conservative than this one. It could have originated with any well trained choir, from a variety of denominations in a variety of countries. The singing and the accompaniment is well disciplined and well balanced, but without the slickness of some professional choirs.

Perhaps it is this very "our church" quality that will commend the recording to many. And I'll be surprised if you don't know every one of the hymns: Abide With Me — There Is A Green Hill — The Day Thou Gavest — Eternal Father, Strong To Save — The Lord Is My Shepherd — All Things Bright And Beautiful — Jesus, Lover Of My Soul — Nearer, My God To Thee — Praise My Soul The King Of Heaven — The King Of Love My Shepherd Is — Glorious Things Of Thee Are Spoken.

A program of straight hymns like this could be dreary but this one isn't. Because the particular hymns have won a place around the world, and because they are sung simply, sincerely and well, they need no further commendation. (W.N.W.)

★ ★ ★

THE REAL THING. Stereo, Word WST-8584-LP. (From Sacred Productions Australia, 181 Clarence St, Sydney and other capitals).

Call this, if you like, a sampler of modern Gospel music available on the American Word and Myrrh labels. The notes, alternatively, present it as an illustration of how the Gospel sound has broken the ties of tradition to present its message in present day musical styles.

If your tastes in Gospel music run along traditional or conventional lines, this one won't be for you. If you have any doubts, listen to track 1 and hear what the Spurlows do to "This Little Light Of Mine".

On the other hand, if you've been brought up on a steady diet of pop, you'll dig what Word engineers have put together here for you: This Little Light Of Mine — Sunny Day — God Speaking To You — Say I Do — Take A Look Around You — Comin' — Get It Together — I Need You Every Hour — Psalm 19 — Help Me Care — We Are One — Refuge.

Not for me thanks — but then you're not me! (W.N.W.)

DUST. Stereo, Myrrh MST-6504-LP. (From Sacred Recordings Australia, 181 Clarence St, Sydney and other capitals).

The jacket notes helpfully explain that Dust is the name of a Gospel group which prides itself in being able to perform in a wide range of musical styles. If rock turns you on, track 1 will do the trick. If you're interested in sonic effects, you'll find yourself listening to liberal use of guitar wow, reverberation sustain and moog-like voicing of an electronic organ. The piano comes to light in an unusual off-beat accompaniment supported by organ and percussion; then a harmonica, played in a manner that wouldn't shame Larry Adler.

Off hand, I'd say that Dust is one of the most musically accomplished Gospel groups I've ever heard and if you want a study in "with it" Gospel music, you should certainly listen to their album.

The message is in the vocals which sometimes have to battle the accompaniment: Gone — My Song — Rich Man — Friend Of Mine — Sweet Jesus — Sunny Days — Stand By Now — What's The Us — He Aint Heavy, He's My Brother.

You'll probably gather that, in commending Dust for their musicianship in the most modern sense, I'm defining the potential audience. If you're a wrinkly like me, or even a semi-wrinkly, you'll spend your money on something a little more conservative from the Sacred Productions library! (W.N.W.)

★ ★ ★

REAL. The Gospel Heirs. Stereo, Unison BRC-024. (Through retailers or from Troubadour Records Pty Ltd, PO Box 41, Balmain 2041).

About three weeks before receiving this album I was present at a most enjoyable Gospel concert presented by the Gospel Heirs. During recent years many others in the Sydney area have had a similar pleasure. The music, vocal and instrumental, is modern without being mod. and extensive platform experience has taught the Gospel Heirs what goes over well with audiences drawn from all age groups.

Those who have enjoyed their vibrant, yet very sincere Gospel presentation will welcome their album and some of the many numbers in their repetoire: Sing Of God's Love — Reach Out To Jesus — Who Are You — Somebody Bigger Than You And I — When I Cried From The Depths Of My Soul — Day Of Judgment — Sweet By And By — There Is More To Life — There's Just One Way — No Need To Worry — I See God — Living Circle.

Here and there, particularly on side 1, one senses some tension, a tendency to try too hard, as against the warmth of a stage performance but the group has measured up very well to the often traumatic experience of exchanging a sympathetic audience for a recording studio. Well worth a hearing. (W.N.W.)

★ ★ ★

THE CHILDREN SING. The Children of the Parkes Methodist Junior Choir. Conductor, Ron Watts. Organist, Fay Page. Mono, Parker PR-006. (From Parker Recordings, 9 Carmel Place, Winston Hills 2153. (... including pack & post).

Arriving in its unpretentious white cover, this album has two or three surprises in store. The first is the quality of the pressing — in the thin RCA format and completely free from surface noise or imperfections. The second is the organ — not the electronic that one would expect in a remote Australian country church but a Noad pipe instrument.

And the third, as you might has guessed, is the choir itself. Thirty-four young people between 8 and 18 who sing with the assurance of veterans and a discipline that does credit to their accompanist and their conductor. You may, in fact, have heard them by the time you read this review — the album having won for itself air time both in Sydney and in the western districts of NSW, as well as pre-Christmas appearances on country television.

I will not try to list all sixteen tracks but here are some of them: Nothing Is Impossible — The Engine Song — Happiness Is The Lord — Peace, Be Still ! — Song of A Soul Set Free — Everyobody Sing — Turn Your Eyes Upon Jesus — Wonderful Grace Of Jesus — Mine Eyes Have Seen The Glory. Among the others are four Christmas carols.

Well presented and well recorded, the performance has a sincerity and a freshness that is quite captivating. Recommended, if you have any interest at all in children singing. (W.N.W.)

Instrumental, Vocal and Humour

IMMORTAL MELODIES. Christian Ferras, his Magic Violin and the Collegium Academicum de Geneve, conducted by Boris Mersson. Compatible stereo, SMS 2785, Concert Hall Record Club (130 Parramatta Rd, Ashfield 2131).

Thinking back through the many hundreds of records I have listened to in recent years, it suddenly struck me how few have featured solo violin. This fact alone should add interest to this Concert Hall release featuring that very talented violinist Christian Ferras. In a program of classical miniatures he presents: Obertass (Wieniawski) — Slavonic Dance (Dvorak) — Nocturne in E Flat (Chopin) — Tambourin (Leclair) — Moment Musical (Schubert) — Sicilienne (Von Paradis) — The Bee (Schubert of Dresden) — Song Without Words (Mendelssohn) — Clair de Lune (Debussy) — Serenade Melancolique (Tchaikovsky) — Cradle Song (Schumann) — Chanson Triste (Tchaikovsky).

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Gil Wahlquist (G.W.), and Norman Marks (N.J.M.).

VARIETY FARE

Appropriate to the music, the violin occupies centre stage with the orchestra demurely in the background. Played at low level, it will double as very pleasant mood music. The balance is good and the pressing free from any sign of noise background. (W.N.W.)

★ ★ ★

SWISS MARCHES. The "Bedzus" band conducted by Jean Louis Schmidt. Concert Hall synchro stereo SVS 2634.

Switzerland is the last place one would expect to be the origin of martial music but apparently the Swiss are such intense patriots that marches are very popular. At any rate, this record should be quite popular with fans of march music. The band, to my mind, is good but not outstanding. Similar remarks can be made about the recording quality — synchro stereo does not provide wide stereo separation. Track titles are in French but the marches are all of Swiss origin. (L.D.S.).

★ ★ ★

SPY TIME. David Lloyd and his London Orchestra. Horizon stereo SH66 94062. Manufactured in Australia by Festival Records Pty Ltd.

Regardless of whether one likes the odd spy movie theme, a complete record of this music is deadly — boring, that is. And David Lloyd and his orchestra have managed to completely obviate the individuality of each tune so that they all sound the same. Recording quality is standard.

Twelve tracks are featured: Goldfinger — 007 — On Her Majesty's Secret Service — James Bond Theme — From Russia With Love — The Man From UNCLE — The Spy Who Came In From The Cold — Secret Agent Man — The Spy Who Loved Me — I Spy. (L.D.S.)

★ ★ ★

BUDENZAUBER CRAZY PARTY. Werner Muller and his orchestra. Decca stereo SKLA 7690.

Many of Werner Muller's albums are, to my mind, flops but this disc gets the nod of approval as a highly effective and noisy party record. The group can best be described as a "honky tonk" band. Some tracks have vocal accompaniment. Recording quality is good and the stereo separation is sharply defined.

Playing time is generous, with a total of fourteen tracks. Some of the tunes presented are: America — Do Wah Diddy Diddy — I Feel Fine — Hello Dolly — Memphis, Tennessee — Whistle Stop — Pretty Woman. (L.D.S.).

★ ★ ★

JUST FOR YOU. Gene Pitney. Musicor Records stereo SH66 94087. (Festival Records Pty Ltd).

Whether or not this album is recently produced or a re-issue, I cannot tell but it should be popular with Gene Pitney fans as it features several of his hits from the past. Quality of the recording is good.

Twelve tracks are presented: Teardrop By Teardrop — Mecca — Cornflower Blue — Not Responsible — The Angels Got Together — Don't Let The Neighbours Know — The Ship True Love Goodbye — House Without Windows — Aladdin's Lamp — Time And The River — Peanuts, Popcorn and Crackerjacks — Tell The Moon To Go To Sleep. (L.D.S.)

★ ★ ★

THE WORLD OF MECHANICAL ORGANS. Decca Stereo SPA 115.

In the years BC (Before Circuitry) one practical way of producing stereo music on a grand scale was by means of a large pipe organ. And if the provision of a competent organist was too much of a liability for dance halls and fair grounds, why worry? You punched out the music in cards or a paper roll!

And by golly, did they punch holes! Over-registration was often compounded by a complete lack of expression and a mechanical rhythm as well but it must have been a beaut noise around 1910!

Some recordings of single mechanical organs have been just too much for more enlightened ears but this album has a lot to commend it to organ enthusiasts and others with an interest in musical history. The reason is that Decca engineers have brought together fourteen selections from seven different instruments, each one the subject of a jacket note. Some of the music is heavy, mechanical

and over-registered. Other items have a sound which is not at all unlike what one might expect from a live organist playing a traditional Wurlitzer or Christie.

The selections: Fanfaren Klange — Petite Waltz — Dam Busters March — In The Toyshop — Broken Doll — Just Once For All Time — Im Reiche Der Venus — Graf Zeppelin March — Castello — That's My Weakness Now — Paris — Donauwellen Waltz — Le Merle Blanc — Wintersturme Waltz.

The recording quality is excellent. Come to think of it, this is a must for popular organ fans. (W.N.W.)

★ ★ ★

MOZART — EINE KLEINE NACHTMUSIK and other works for string orchestra. I Musici. Stereo, Philips "Universo" series, 6580 030.

Mozart's popular string serenade "Eine Kleine Nachtmusik" (sometimes translated as "A Little Night Music") is beautifully played here by the Italian string orchestra I Musici. This seems to me a virtually ideal performance, finely phrased and played with great smoothness and full bodied tone. This program of popular string compositions is completed by Adagio and Fugue in C minor — Divertimento in D, K.136 (not, incidentally, the one with the famous Minuet) — Serenade in D ("Serenate Notturna"). The highest standards of playing are maintained throughout.

The orchestra has been very well recorded, instrumental balance is good and the sound is very clean. Excellent value at the "Universo" price. (H.A.T.)

★ ★ ★

TIM CONNOR. Stereo, Festival FL-34678.

Anyone who has watched Mike Willesee's "Current Affair" on TV at all regularly will need no introduction to the talented young Irish singer Tim Connor. And you need have no fear that his performance loses from lack of the video image. Working close on mic, Tim Connor achieves a high degree of intimacy enhanced, in

4-channel Stereo

GREAT FILM AND TELEVISION THEMES. Cyril Stapleton and his orchestra. Quadraphonic QS, Astor QUAD 1003.

Most of the 4-channel recordings reviewed to date have been recorded using SQ encoding. In this one, the system used is the Sansui QS. Using a simple playback matrix there is a difference between the two but until my reviewing set-up has accurate matrices for all the rival systems, I am not going to proffer opinions about separation.

Bypassing that question, this recording by Cyril Stapleton makes no effort to fill the room with spectacular sound, or to show off matrix technology. His purpose is simply to entertain with gently swinging sound and the fact that it is dispersed a little more than usual is beside the point. The result is that the album is very easy on the ear.

The tracks: Diamonds Are Forever — Sleepy Shores — "Onedin" Theme — Nicolas and Alexandra — I Could Be Happy With You — Death In Venice — The Persuaders — The French Connection — Sunrise, Sunset — "Gumshoe" Theme — "Raising The Roof" Theme — Le Casse.

Pleasant in stereo, with quad as a bonus. (W.N.W.)

★ ★ ★

HARP TRANSPLANT. The Harp of David Snell. Quadraphonic QS, Astor QUAD 1002.

What an odd choice for quadraphonic presentation — an instrument that by its very dimension is more appropriate to a single channel. However, producer Tony Palmer makes no attempt to create a harp which is sonically as large as your living room. He leaves the harp where it should be — up front. It's the percussion that gets the stretch treatment, keeping it where it won't crowd the star performer. Not so silly, after all!

A pianist from way back, David Snell carries something of the atmosphere of the cocktail piano into his harp but, of course, the sound is much harder and incisive. Composers new and old feature on the respective sides: Close To You — Do You Know The Way To San Jose? — This Guy's In Love With You — Both Sides Now — Wichita Lineman — Call Me — Eine Kleine Nachtsmusik — Invention In A Minor — Fure Elise — Gavotte In G Minor — Praeludium — Trumpet Voluntary.

The use of the quadraphonic format is intriguing but, once again, the real interest of the album is in the music, which is both unusual and very listenable. (W.N.W.)

VARIETY FARE . . . cont.

certain numbers, by cleverly contrived double recording.

On side 1 "Johnny, I Hardly Know You" and "Strange Rain" are eloquent message songs while "It's The Same The Whole World Over" is a spirited bit of nonsense. The other numbers on side 1 are "Amy" and "If I Were A Carpenter".

One side 2: I'll Stay Single — Ode To A Critter — The Greatest Discovery — Strawberry Farm — Dirty Old Town — If You Could Read My Mind.

Tim Connor is good, very good! He deserves a place in any collection. Recommended. (W.N.W.)

★ ★ ★

GREAT TRUMPET CONCERTOS, Roger Delmotte, trumpet, with the Collegium Academicum de Geneve, conducted by Robert Dunand. Stereo Concert Hall Record Club SMS 2784.

There are three trumpet concertos in this program, including the very popular Haydn work in E flat major; one by the baroque composer J. F. Fasch, in D major; and the D major by Leopold Mozart, which has only two movements. The program is completed by the three movement Sonata for trumpet and strings, by Henry Purcell, which is virtually a concerto by another name; and two shorter pieces — Purcell's Trumpet Overture from "The Indian Queen"; and the well known Trumpet Voluntary by Jeremiah Clark.

This interestingly varied program is played with exemplary technique and tone by the Frenchman Roger Delmotte, with sound support by the orchestra. The recording in Concert Hall's "Synchro Stereo" process is clean and bright. In summary, a thoroughly enjoyable disc, well worth the club price. (H.A.T.)

★ ★ ★

1812 Overture and other orchestral works— Tchaikowsky. The Philharmonic and Royal Philharmonic Orchestras, conducted by George Weldon. Stereo. HMV Concert Classic Series, SOELP 9870.

Any disc featuring the old warhorse "1812 Overture" is likely to be greeted with a groan by record reviewers, who have heard it ad nauseam. However, this is a stirring and robust performance, and has the added interest of real cannon, carefully cued in, according to Tchaikowsky's original intentions. The Band of H.M. Royal Marines add their very worthy contribution. And although this is a budget-price disc, the sound is remarkably good, with wide dynamic range, full rounded bass and clean treble. The stereo is smoothly and widely spread, and the catalogue of merits of this disc may be completed by reference to the generous program, which also comprises the Capriccio Italien — Waltz and Polonaise from Eugene Onegin — Waltz from "Serenade for Strings" Excellent value. (H.A.T.)

★ ★ ★

SCHUBERT: PIANO MUSIC — Vol.6. Noel Lee, piano. Stereo. World Record Club. S/5237.

In this sixth disc of the series I was not aware of some of the aspects of Noel Lee's

playing that I found disturbing in earlier discs. It seemed to me he was much more fluent in his playing, his phrasing more sensitive, and his control of dynamics entirely satisfactory.

The program consists of two works — the three movements of the unfinished Sonata in F minor, D.625, to which Noel Lee has added the Adagio in D flat major, D 505; and the four movement Sonata in A minor op.42, D.845.

These sonatas contain some of Schubert's most inspired writing for piano, alternately tender and passionate, suavely melodic and tumultuously dashing. I believe Noel Lee has explored the possibilities of these sonatas more thoroughly than some of the others he has played in this series. The result is certainly an experience which Schubert lovers should find entirely satisfactory. The sound is fine too, as it has been in the other discs in the series. (H.A.T.)

★ ★ ★

THE MESSIAH — Handel. Stereo, World Record Club. Three-disc boxed set, S / 5233-4-5.

This three-disc set has the complete version, using Handel's original instrumentation. The cast of singers is headed by Joan Sutherland, and I am sure this will prove the major attraction for most buyers. The other soloists are Grace Bumbry, contralto; Kenneth McKellar, tenor; David Ward, bass. The conductor is Sir Adrian Boult; and if you search carefully, you will find reference in the small print on the disc labels that the London Symphony Orchestra and Chorus complete the list.

The performance is a very sound one, characterised by sound professionalism and careful attention to detail throughout in all departments.

However, it appears to be quite old, probably dating from around the later 1950's. Accordingly the sound is noticeably deficient by today's standards, cut at fairly low level and restricted dynamic range, and there is some clumsy tape joining in some tracks which would certainly not be tolerated by record producers today. (H.A.T.)

★ ★ ★

"NEW WORLD" SYMPHONY (DVORAK) and Manfred Overture (Schumann). NBC Symphony Orchestra conducted by Arturo Toscanini. Stereo RCA Victrola VICS-1249.

Here is a brilliant performance of Dvorak's most popular symphony, available on the low-price Victrola label and with the very generous addition of Schumann's "Manfred" Overture — one of his most inspired creations. The blurb on the sleeve says "The music glows and pulses with life . . ." and for once I must agree that the phraseology is appropriate. I would anticipate that many people who buy this disc will discover greater depths and new beauties in this music than they suspected.

The performance of the symphony dates from 1953 and a somewhat puzzling circumstance is that the recording is undoubtedly in genuine stereo, not "electronically reprocessed" . . . While the sound is undoubtedly dated, the average music lover should soon adjust — I must say I personally was not conscious of any great technical deficiencies while listening, except in the bass region where the instruments, and particularly the drums, sound somewhat muffled. In general, for its age, the sound quality is surprisingly good. (H.A.T.)

★ ★ ★

WINTERREISE (Winter Journey) — Schubert. Peter Pears, tenor, and Benjamin Britten, Piano. Stereo, World Record Club. Two record set, S 188-189.

Regarded as Shubert's masterpiece in song cycles, "Die Winterreise" has been recorded by many eminent singers "in toto" since the LP disc made such large scale enterprises possible. My personal collection includes versions by Hans Hotter and Fischer-Dieskau. Nevertheless, I am glad to add this version. This is a sensitive performance, in which the performers convey the sadness, disturbed mind and finally, near madness, of the disappointed lover with conviction. Peter Pears has his voice under perfect control throughout and I personally find nothing to complain about in his tone, which some people are apt to criticise. Britten is entirely satisfactory in his role of accompanist, playing Schubert flowing passages with the fluency they require. The Schubert work takes up three sides, and side four has Schumann's "Dichterliebe" (Poet's Love) — 16 short songs which include such well known pieces as In the Beautiful Month of May — I Do Not Chide — From Old Fairy Tales. Far from being anti-climatical after Schubert's genius, the interest is maintained, not only by the undoubted quality of the music but also by the sustained excellence of the performers.

This recording dates from the early sixties and is typical of the best recordings of that priod — clean and with minimal distortion, and able to satisfy all but the ultra-critical hi-fi fanatic who insists on the ultimate in sound quality. (H.A.T.)

★ ★ ★

THE WORLD OF MOZART. Various artists and orchestras. Stereo, Decca, SPA 251.

This pleasing disc should have wide appeal, not only for those seeking a closer acquaintanceship with the music of Mozart but also for those already familiar with this composer's music who like to relax to a lighter program occasionally. Only top ranking artists are represented in this collection, including big names such as The Vienna Mozart Ensemble, Teresa Berganza, Wilhelm Backhaus, Julius Katchen, Lucia Popp, Gervase de Payer and Barry Tuckwell.

The works represented are: Eine Kleine Nachtmusik — Marriage of Figaro — Piano Concerto No.20 (Romance) — Don Giovanni — German Dance ("Sleigh Ride") — Exultate Jubilate — Rondo Alla Turca — Symphony No.40 — Cosi Fan Tutti — Clarinet Concerto — The Magic Flute — Ave Verum Corpus — Horn Concerto.

Some variation in sound quality is evident, as one would expect from tracks from discs issued over a period, but this is never less than satisfactory, and at the low price asked the disc is excellent value. (H.A.T.)

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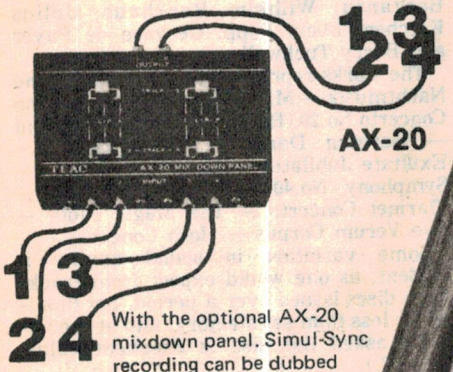

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VARIETY FARE . . . cont.

THE YOUNG WINSTON. Musical from the original sound track of the film, composed and conducted by Alfred Ralston with excerpts from the works of Elgar. Stereo. His Master's Voice C3DA 9002.

In the sleeve note which he has written for this album, producer Carl Foreman says ". . . the musical score of 'Young Winston' composed by Alfred Ralston, containing as it does his own witty, original music, the strains and themes of popular songs of the period selections from particularly opposite works of Sir Edward Elgar, make Ralston's score one of the best film scores . . . I have ever encountered." While there may be some truth in this assessment from a purely cinematic viewpoint, I cannot see that a score of this type has much relevance outside the cinema. The bits and pieces nature of the score imposed by the requirement to fit specific scenes and actions in the film prevents any musical continuity and I cannot imagine many people putting this disc on their turntable for musical enjoyment. I should have thought some of the dialogue from the best scenes would have added interest. As usual, this disc will have the most attraction for people who found particular enjoyment in the film. Sound and stereo are of normal modern standards. (H.A.T.)

★ ★ ★

WORKS OF ART. Art Kaub on the Thomas Palace III. Stereo, Troubadour TCS-025. (From Troubadour Records Pty Ltd, PO Box 41 Balmain, NSW 2041).

For some strange reason, I almost missed reviewing this one but better late than never — it's a beauty! In fact, when I put it on the turntable, I completely forgot I was supposed to be reviewing it; it was a pleasure to listen to.

Art Kaub is a superb popular musician and listening to the performance, one needs no convincing that he is a composer and arranger as well as an artist in his own right.

No less notable are the sounds that he wins from the big Thomas. There is an incredible piano stop, accordion, violin, music box, steel guitar, string bass, percussion and a variety of other sounds — all introduced in the most natural possible manner. The amazing thing is that no double recording was used at any stage. As the jacket says: It's all the Works of Art!

Swinging Gently — Talk Of The Town — Satin Doll — I Get The Blues when It Rains — Lara's Theme — St Louis Blues — Something — Malaguena — To You Sweetheart, Aloha — Funny How Time Slips Away — I Will Wait For You.

Last but not least, the recording itself is completely above reproach. This one is a "must" for popular organ enthusiasts. (W.N.W.)

★ ★ ★

GOLDEN HOUR OF MARCHES. Pride of the 48 Band Astor Golden Hour Series. Stereo GH806.

If you are keen on Marching music you will get your fill with this disc of 23 well known tunes. The titles include: Stars and Stripes for Ever — Washington Post — Liberty Bell March — Hands Across the Sea — El Capitan — Under the Double Eagle — American Patrol — Rule Britannia — RAF March Past — Soldiers of the Queen — Marines Hymn — March of the Toys — Pomp and Circumstance — Men Of Harlech and Life on the Ocean Wave.

The recording quality has suffered somewhat in dynamic range and overall quality, due most likely to the effort of getting almost 60 minutes of music on to a single 12"LP.

But this comment aside, for march enthusiasts this record would be a good buy. (N.J.M.)

★ ★ ★

RUSSIAN CHOIR. The Aleksander Gavanski Choir. Directed By Professor A. Gavanski. Europa Stereo E321. Released by Astor.

One would have to be multi-lingual to know the titles on this record, as the song titles are in German on the record label and in Russian on the jacket, with German sleeve notes. But don't let this deter you from enjoying eight Russian folk songs sung by a beautifully disciplined choir. Apart from a slight harshness on some high notes the quality is good with normal stereo spread. (N.J.M.)

★ ★ ★

REVUE 1919-1929 ORIGINAL ARTISTES EMI Mono OXLP 7559.

If nothing else, anyone hearing this record of music hall artistes going back to 1919 should appreciate the high standard of modern recording and playback equipment. The list of performers reads like a "who's who" of show business in the decade from 1919 to 1929 — people such Beatrice Lillie, Jack Buchanan and the Trix Sisters, Elsa Lanchester, Jessie Matthews, Cicely Courtenidge and George Metaxa. The record quality is understandably poor, but as an object lesson to the younger listener or a nostalgic trip for those that remember those days, it would be a good buy. (N.J.M.)

★ ★ ★

THE SOUND OF MUSIC. Alyn Ainsworth Orchestra with Anne Rogers, Patricia Routledge and supporting cast. Axis Stereo 6048.

If you missed out on the original soundtrack recording of this show, this record at the Axis budget price is a worthy substitute. Although the original stars are missing, the artists on this present disc give a competent and enjoyable performance of all the main songs of the show: Sound of Music — Maria — I have Confidence — Sixteen going on Seventeen — My Favourite Things — Climb Ev'ry Mountain — The lonely Goatherd — Something Good — Do-Re-Mi — Edelweiss — So long Farewell.

The recording quality is excellent and the stereo normal (N.J.M.)

★ ★ ★

UNFORGETTABLE SONGS By Vera Lynn EMI Columbia Stereo SCXO 6500.

It gives one a start to hear such a youthful voice on this record, when one remembers wartime records of "We'll Meet Again" and "There will be Blue Birds over the White Cliffs of Dover" sung by the same artiste. The titles include Put your hand in the

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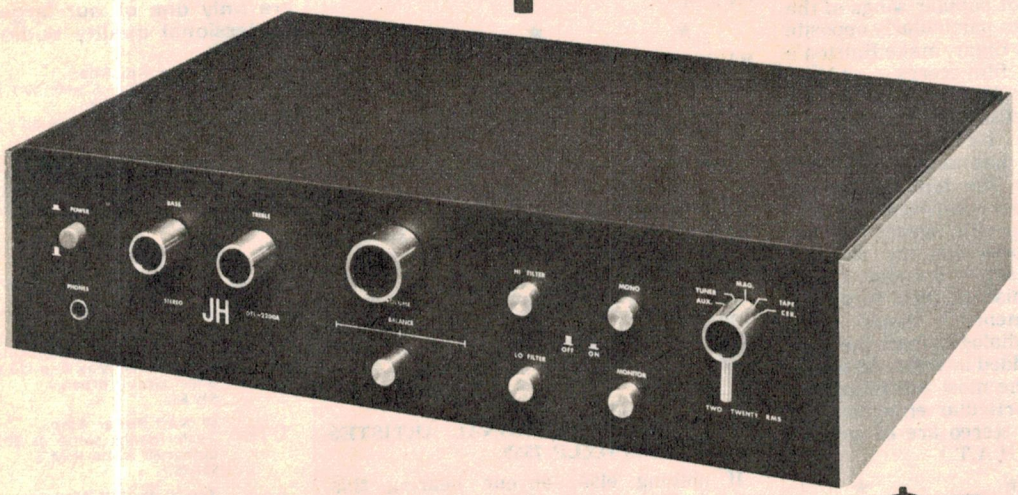

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VARIETY FARE

Hand — Unforgettable — Birth of the Blues — Its Impossible — I think of You — If we only have Love, and six others including two medleys. With the backing of the Alyn Ainsworth Orchestra the recording quality is excellent with normal stereo. (N.J.M.)

★ ★ ★

SONG PARTY WITH THE OLD KENT ROADSTERS. Astor Rediffusion Stereo GGS1202.

A bright, singalong party record would be the best description of this disc, with 12 old and not so old hits, such as: Carolina — Row Row Rosy — Cinderella Rockerfella — The Old Piano Roll Blues — Play a Simple Melody — The Spaniard That Blighted My Life.

The recording quality leaves little to be desired and the honky tonk piano backing to the singers certainly sets the party mood. In short, a good ice breaker to get things swinging. (N.J.M.)

★ ★ ★

ECHOES OF STEAM. NSWR Steam at work, 1971-2. Stereo, 45 EP Locofonic LRS-001.

Anyone who has ridden as many miles behind steam locos as I have will not need a second invitation to listen to some of those locos again, in stereo. Better than that, I played this recording in similated quadraphonic and, with the gain well advanced, the locos really did blast their way through my living room.

The six tracks on this EP recording will reintroduce to enthusiasts NSW locos 5910, Garratt 6026, twin Garratts 6037 and 6018, old-timer 3246, another old timer 5189 and express loco 3813.

Recorded originally for a purely private collection, the sounds are being offered on an EP recording to gauge whether enough enthusiasts want recordings of this nature to make their release worthwhile. The quality, by the way, is excellent.

If you want this EP, it will cost you $2.35 including postage to any address within Australia. Comments would be welcomed by the producers: Locophonic Recording Service, PO Box 124. Northbridge 2063.

★ ★ ★

ACCORDION UP TO DATE 2. The Heinz Elme Sound played by Fred Hector and his Accordion Orchestra. Stereo. Polydor 2371074.

Featured in this album is the happy continental sound of the accordion. If fact, several accordions are used — but sparingly — including a special baritone instrument, able to provide a sound of greater sonority than usual. Also included is a guitar, percussion and an electric piano.

The track titles: Bond Street — Happy Heart — Mame — Remember Natascha — The Shadow Of Your Smile — Those Were The Days — Aquarius — Spanish Eyes — Hello Tramp — The Green Leaves of Summer — Love Is Blue — A Banda.

The sound is clean and well balanced, the surface is virtually flawless and, as I remarked before, it's a happy sound by built around accordion reeds. (W.N.W.).

ALOHA MOODS. The Aloha Moods Orchestra. Stereo, Horizon (Festival) SH66-94084.

"Here is music to put you in the Aloha mood": So runs the jacket note and that's exactly the kind of music it is — gentle basic rhythm with steel guitars, relieved here and there by a touch of accordion, organ and chorus. The songs are as familiar as the sound: Moon Of Waikiki — Little Grass Shack — Drifting and Dreaming — The Luan Song — To You Sweetheart Aloha — Harbour Lights — For You A Lei — Hawaiian Wedding Song — Moonlights And Shadows — Mauna Loa.

Pleasantly and cleanly recorded, you'll like it quite automatically if you like Hawaiian music — and it is easy on the ear! (W.N.W.).

Nashville Album

POPULAR HITS FROM NASHVILLE. 108 Pop Songs by 25 Great Nashville Stars. Stereo, Reader's Digest / RCA Dynaflex 9-record boxed set.

RCA's Nashville studios have acquired a reputation worldwide for pleasantly swinging rhythm, with a sniff of country style — built around a team whose names are as familiar as they are a part of Nashville. Try these: Jim Reeves, Anita Kerr Singers, Floyd Cramer, Chet Atkins, Connie Smith, Eddy Arnold, Duane Eddy, Hank Snow, Jimmy Dean, Bobby Bare, Skeeter Davis; and many others. You've heard them all before, many times; Reader's Digest simply brings them together in one program that would probably take the best part of five hours to play through.

I certainly did not attempt this feat of endurance for the purpose of the review but I picked my way through a representative number of tracks without hearing a single sour note or the slightest hint of noise or distortion. Musically and technically the set must be given full marks.

On each of the eighteen sides the music — most of it well known — follows a particular theme. In fact, the themes dominate the presentation so that, in fact, it is primarily a program of middle-of-the-road popular music, but performed by Nashville artists.

The themes: Gentle on My Mind — Songs Of the Young World — I'll Follow The Sun — All-Time Favourites — Nashville In Swing — Misty Blue Hits — In Hollywood — Blowin' In The Wind — Mr Guitar: Chet Atkins — True Love — Broadway Hits — Memories Are Made Of This — Fiesta Nashville Style — Nashville Salutes The Beatles — New World In The Morning — Strangers In The Night — Nashville On The Road — What The World Needs Now Is Love.

From the title of the set I expected fairly solid emphasis on country style, with reviewing a duty rather than a pleasure. In fact, it turned out to be just the reverse and a set that I can commend to anyone with an ear for popular music of the more tuneful kind. (W.N.W.).

CATCH BULL AT FOUR. Cat Stevens. Island Records stereo IL 34663. Distributed by Festival Records Pty Ltd.

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VARIETY FARE

so original and so well done that it is surprising he does not have more copiers. He certainly has the fans. And most of them will already be familiar with his latest album "Catch Bull At Four" so my remarks will be for the unconverted.

One of the points that sets Cat Stevens apart is the clarity of his diction—it is as though he wants you to listen to what he is singing. And it is worth listening to. No doubt this album will be the source of many discussions in the high schools. The clarity is carried through to the instrumentation and the recording process. This too is a hallmark of Cat Stevens.

Another interesting feature is the large number of instruments he and his accompanying musicians use to obtain the effects he desires. Apart from the acoustic guitar and Moog synthesizer, these are featured: piano, electric mandolin, drums, bass, Spanish guitar, electric piano, penny whistle, bouzouki, organ and percussion.

The words of the ten songs are provided inside the cover. Titles: Sitting — Boy With A Moon & Star On His Head — Angelsea — Silent Sunlight — Can't Keep It In — 18th Avenue — Freezing Steel — O Caritas — Sweet Scarlet — Ruins. (L.D.S.)

Jazz and Rock . . .

MODERN JAZZ QUARTET. Prestige records stereo SPR 225 / 6.

The release of the quartet sides from Prestige may reawaken the argument over the merits of Kenny Clarke against Connie Kay as drummer with the MJQ.

This music comes from the Clarke era, when Clarke's drumming and Milt Jackson's vibraphone playing dominated the music of the group. The subtleties of John Lewis at piano were overshadowed in those distant days. It was only in something like "Django" that the staggering improvisations of Lewis were fully appreciated.

"Django" is one of the jewels on this two-LP set.

There is the "La Ronde" suite, a Gershwin Medley (with Connie Kay) and great things like "Vendome," "Concorde" and "Ralph's New Blues." Some of the recordings are pre-stereo and the sound quality is uneven. (G.W.)

★ ★ ★

SAINT DOMINIC'S PREVIEW. Van Morrison. Warner Brothers stereo BS 2633.

Van Morrison's latest LP of personal, introspective songs revolve around the song "Listen to the Lion". This lasts more than six-minutes, has an interesting lyric, and allows Morrison to spread himself in a way which reminds me of a solo instrument in jazz.

Morrison is great at repeating a phrase, changing the intonation each time as the performance builds in intensity.

That Morrison has an ear for jazz is shown in "I Will Be There" which is in the Count Basie Kansas City style. (G.W.)

★ ★ ★

LATIN AMERICAN SUITE. Duke Ellington and his orchestra. Fantasy stereo SFYL 934635.

The tremendous resources of the Ellington orchestra come to the fore in this musical and witty suite recorded four years ago after the band's first tour of Latin-America.

Although inspired by South American music, the playing is completely Ellington. The Duke does not use congas, bongos and other Latin rhythm instruments. He presents a jazz impression in the band's own language. When Latin rhythms are played, they are by the Ellington rhythm section.

Soloists are Johnny Hodges, Paul Gonsalves (saxophones), Buster Cooper (trombone) and Ellington at piano.

In "Oclupaca", "Eque", "Latin American Sunshine", "Brasilliance" and the other numbers it is predominantly an orchestral sound, rich and enthralling. (G.W.)

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Melb: Zephyr Products Pty. Ltd. 56 7231
Adel: General Equipments Pty. Ltd. 63 4844
Bris: Douglas Electronics Pty. Ltd. 97 8222
Perth: H. J. McQuillan Pty. Ltd. 21 4821
Everett Agency Pty. Ltd. 84 137
Henderson (N.Z.) 64 189

PLESSEY
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AD54

PRODUCT REVIEWS AND RELEASES

Sony TA-88 integrated amplifier

Quite often when contemplating the purchase of audio equipment for the home, one is faced with the problem of how to fit everything in the space available. One leading manufacturer, Sony has come up with a product that could help to ease this situation.

The Sony TA-88 Integrated Amplifier, as illustrated, exhibits a break from conventional styling that makes a lot of sense, particularly in today's restrictive planning situations.

Instead of the usual horizontal styling, occupying perhaps 14 to 18 inches of shelf space, the TA-88 requires only 5¼ inches, a height of 9¼ inches and a depth of 9½ inches, allowing for plugs and cables.

Though small, the case is finished in a satin walnut veneer, with a ventilation grille at the top rear in a matching brown enamel.

The front panel is in two sections. The upper portion, in satin-grained aluminium, carries the slider tone controls, the source selector switch, a row of tiny lamps to give at-a-glance indication of the selected program, and the slider volume controls for each channel. Highly functional, the last named obviate the need for a balance control.

The lower section of the panel accommodates the headphone jack, three tab switches for filter, mode and monitor, together with the mains switch.

Around the back, the rear panel, with it's 28 square inches of space, is fully occupied with input and output facilities.

Near the top there are two rows of RCA type input sockets for phono, tuner, auxiliary, and tape in and out. Below this there is a 5-pin Din plug duplicating the tape facilities, together with the fuses to protect the output stages. The loudspeaker terminals have an insulating barrier between the screws to minimise the risk of shorts from stray wire strands.

The bottom of the panel is occupied by the mains selector plug and the 3-pin mains inlet recessed plug. The mains connection is of a type becoming common on the continent; with a moulded socket each end of the flex, there is little chance of faulty or dangerous connections.

Access to the interior is a simple matter. Removal of four screws in the back panel surround and screws holding the cushioned feet enable the amplifier to be slid out for possible repair.

Although the design is very compact, there should be no problem in getting at both sides of the two main printed wiring boards. There is ample lead length to swing the boards out of the chassis, after the tab type interconnections have been slipped off.

The plastic flat-pack output transistors are mounted on a heavy aluminium plate that forms part of the sub-frame, ensuring good heat sinking.

The temperature compensating diodes are fitted in close thermal contact with both the output transistors and one of the driver transistors to ensure close control over DC operating conditions. Basically, the amplifier employs quasi-complementary circuitry with a split power supply to obviate the need for output coupling capacitors.

The specifications for such a small package are impressive, as will be evident from the following: RMS power, 18 watts per channel, both driven, into 4ohms; 11 watts per channel, both driven, into 8ohms. Less than 1% harmonic distortion at rated output and sensitivities of 3mV phono, and 250mV for tuner and auxiliary inputs.

All these specifications were met during bench tests, with one qualification regarding the power rating into 4ohm loads. This must be regarded as applying to "program" conditions, as one of the mains fuses opened after 2 minutes at the 16 watts per channel level of sine wave power. On the credit side, this would imply that the amplifier is well protected from electrical abuse.

The "distortion" observed was mainly 2nd harmonic and hum, but at an extremely low level. Under normal listening conditions the unit gave no audible indication of it's presence in the room when the pickup was lifted from the record. In fact the residual noise with all inputs open was only half a microwatt into 8ohms.

The bass and treble control range of +10dB, slightly less than the usual figure, was verified by our tests. At a power level of 12.5 watts per channel the amplifier was flat from 100Hz to 30kHz, rolling off by only 1.8dB at 20Hz.

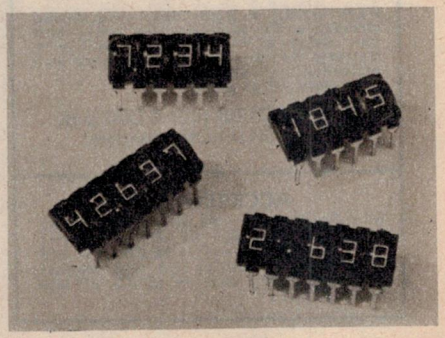
Overall, it must be rated as a well conceived and well engineered product. In short, we liked it!

The Sony TA-88 is distributed by Jacoby-Kempthorne, at 469-475 Kent St, Sydney, and carries a recommended retail price of $145. (N.J.M.)

Compact LED displays from H-P

Hewlett-Packard have released a series of compact end-stackable LED numeric displays giving three, four and five-digit clusters. The 5082-7400 displays have digits 0.11 inches high and are designed for hand-held calculators and portable instruments where power and space are limited. Various decimal point options are available. Packages are standard 12-lead and 14-lead DIL. Price starts at $12.12 for 1-33 quantities, 3-digit unit.

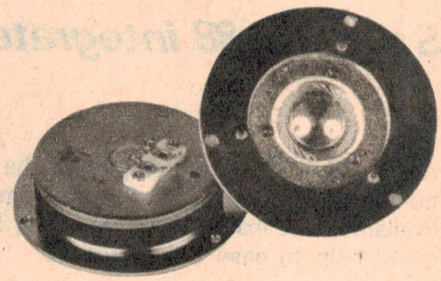
Enquiries to Hewlett-Packard Australia Pty Ltd, 22-26 Weir St, Glen Iris, Vic 3146 or offices in other states.



NEW PRODUCTS

High quality dome tweeter from ITT

Of special interest to high fidelity enthusiasts is a new dome type tweeter loudspeaker announced recently by ITT Components. Manufactured by ITT in the United Kingdom, the unit is credited with excellent transient response and "virtually omni-directional properties over a wide frequency range".



Designated type 4001G, the tweeter is constructed around a high coercivity ring magnet producing a flux density in the gap of 14,000 Gauss. Anticipating that the resulting sensitivity will exceed that of many mid-range and long-travel low-frequency drivers, the manufacturer's leaflet specifies a variable resistive pad, which allows balanced reproduction to be obtained. They specifically warn against relying on amplifier tone controls for this purpose.

Other practical information given in the leaflet includes the recommended method of feed to the tweeter, mounting position in the cabinet relative to the other drivers, observations about phasing, and about the possible deleterious effects of some grille cloths on high frequency response. Interestingly enough, a warning is included about amplifiers which, if unstable, can drive an efficient high frequency tweeter to destruction at frequencies outside the normal range of hearing.

With an overall diameter of 3 inches, the 4001G is designed to mount in a 2-3/8in hole in the main baffle, with the radiating cone flush with (or proud of) the front surface. Nominal cone diameter is 1-inch and normal voice coil impedance 15 ohms.

Response of the 4001G tweeter is rated at 5kHz to 20kHz, plus and minus 3dB. Within this frequency range, the power handling capacity is quoted at 50W maximum peak power. While, like most loudspeaker power ratings, this leaves a lot to the imagination, it would suggest that one 4001G in each stereo channel should cope with the requirements of any normal domestic situation.

On test in our laboratory, the tweeter sounded very smooth and clean, with no obvious lumps or hollows in the frequency range. No less apparent was its wide angle of radiation, its contribution to the total sound being clearly audible almost side-on to the main axis.

In broad terms, its sensitivity would appear to be about right for use with the kind of drivers used in modern compact enclosures. Apart from initial equipment, it would seem to be a likely candidate for situations where an existing system of this type needs some assistance at the top end from an add-on tweeter. In such a role, its contribution can be expected to be pleasant and subtle, rather than stridently obvious.

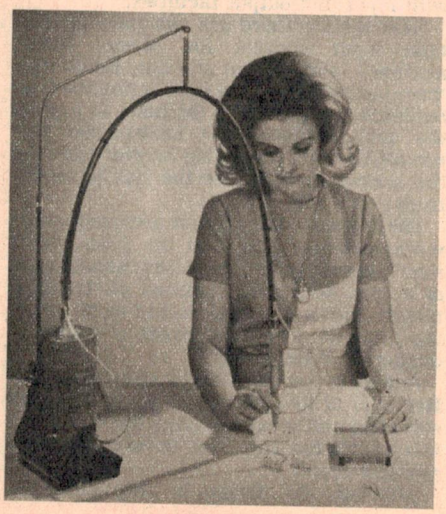
Being regarded by ITT as virtually a professional product, the 4001G tweeter has no recommended retail price, as such. In quantities of 1 to 9 it is available from ITT direct, or from ITT distributors at $26.00 plus tax. Obtained via other sources, some margin for handling may have to be anticipated.

Enquiries may be addressed to Standard Telephones and Cables Pty Ltd, Moorebank Ave, Liverpool NSW 2170. STC have branches also in Melbourne, Canberra and in Upper Hutt, NZ, as well as distributors in Australian capital cities and Auckland, NZ. (W.N.W.)

Power screwdriver

Royston Electronics have announced the local availability of the Foredom Series SL Screwdriver, a US-made production tool designed to increase productivity in miniature assembly. It is particularly suited for difficult or delicate assembly of small mechanical or electrical parts, being capable of vacuum pickup and power driving of all small screws, nuts and similar fasteners requiring up to 5 inch pounds of torque.

The unit can be either bench mounted or suspended, and is quiet, lightweight and easily portable. Operation is from a standard power outlet. Torque is easily adjusted by an external vernier control, and a variety of bits and finders are available. Enquiries to Royston Electronics Pty Ltd, 22 Firth St, Doncaster, Vic.



Dual trace 40MHz oscilloscope

The new "Advance" OS3000 40MHz, dual trace oscilloscope is a welcome addition to the wide range of test equipment from this manufacturer. It provides high performance with versatility and ready portability.

The OS3000 follows the trend of recent years away from the complexity and cost of multi-gun cathode-ray tubes in two trace oscilloscopes towards the use of alternate and chopped trace circuitry.

Weight and size indicate ready portability. Height is 18cm, width 29cm and depth 42cm, while extensive use of light alloys has kept the weight down to a convenient 12kg without sacrificing strength.

Front and rear frames are of aluminium extrusion with the top and bottom covers in charcoal grey vinyl-covered aluminium with a grained finish.

Controls on the front panel follow a logical and tidy layout, with the Y amplifier, trigger and timebase controls using concentric knobs. BNC connectors are used for all inputs and 4mm sockets for ramp and gate outputs on the rear panel.

Two identical vertical amplifiers are provided, with a bandwidth at the -3dB level of DC to 40MHz in the DC coupled mode and in the AC mode, from 5Hz to 40MHz. Sensitivity ranges from 5mV to 20V / cm. A 5 times expansion to 1mV / cm with the bandwidth reduced to 10MHz is available.

The vertical signals are delayed by means of a meander type printed delay line in order to give the timebase starting time for each sweep.

A useful range of vertical display options are provided by the beam switching facility as follows. Y1 only, Y2 only, Y1 and Y2 chopped at approx. 500kHz, Y1 and Y2 alternate and Y1 and Y2 algebraically added. Y2 may be inverted by means of a front panel switch.

The 1mV / cm sensitivity facility would be of great use in analysing the output of vibration transducers, gramophone pickups and similar low level devices. High writing speed is achieved on the 10 x 8cm screen by the use of 10 kV overall accelerating potential.

A 1kHz, 1V square wave calibration signal is available on the front panel. When shorted to ground this source provides a 5mA signal for checking current probes.

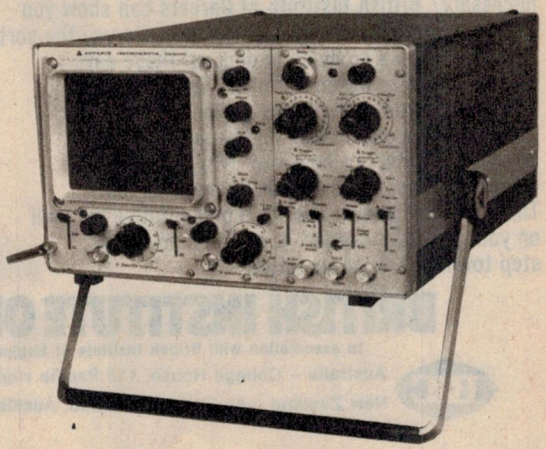
A versatile range of trigger modes are available, including AC, a wide band general purpose trigger; AC fast, for the rejection of low frequency components of a signal; TVF, where a television synch. separator is switched into circuit for the study of television waveforms; and a DC position, where the trigger is optimised for good low frequency performance. In the auto mode the timebase reverts to a free run condition if the signal is too low in amplitude or below 40Hz.

The two timebases are identical in range except for the slowest speed. The 'A' timebase ranges from 200ns / cm to 2s / cm with 'B' going to 1s / cm. The startup of 'B' can be delayed to a point on the ramp of 'A' selected by means of a 10 turn potentiometer, thus enabling various brightup, split timebase and expansion options to be used to advantage by the operator. When using the 'A' intensified by 'B' mode, a portion of the signal is intensified, the width and position governed by the 'B' sweep speed switch and the 10 turn pot, respectively. By switching to the 'B' position the selected section is expanded to full screen width. In the 'A + B' mode the screen is shared by the two timebases, with the proportion governed by the 10 turn pot. This enables the operator to in effect "peel off" the waveform in order to progressively study each portion of a repetitive signal.

A performance check on the bench showed the OS3000 to be a versatile and easy to use test instrument. Measurements made with a number of signal sources revealed a high order of calibration accuracy on both vertical and horizontal ranges. Television waveforms and RF signals around the 30MHz mark were readily locked by the trigger circuitry. Timebase stability is good and would recommend this oscilloscope for photographic recording of waveforms, both in the single shot mode and in the repetitive condition.

With the covers removed, the OS3000 showed a high standard of construction, with major units such as the timebase, power supply and EHT supply readily removable for service. The instruction manual contained a very comprehensive service section with a timesaving programmed checklist for locating faults.

In summing up we feel that the manufacturers have produced an instrument of high performance at a competitive price. Advance are represented by Jacoby Mitchell Ltd, 215 North Rocks Rd, North Rocks 2151. (N.J.M.)

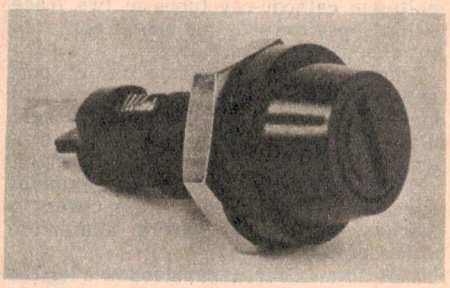


Features of the new OS3000 oscilloscope are chopped or alternate dual trace, dual timebase with delaying, and inbuilt TV sync separator. Useful Y bandwidth extends well beyond 40MHz.

NEW PRODUCTS

Greater safety with new fuseholder

E. S. Rubin are now marketing a new "Rafi" cartridge fuseholder which fully meets the tightened safety standards recently set by the IEC. At no time can the user touch any live part.

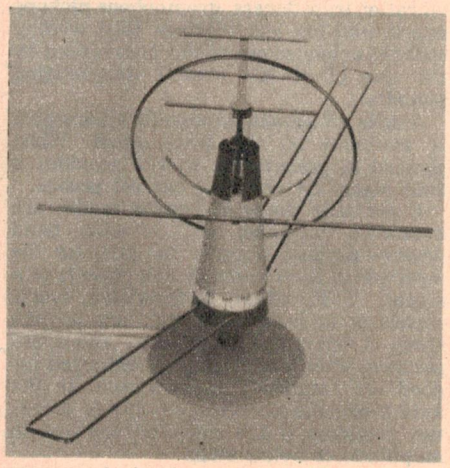


The Rafi type 1.47005 cartridge fuseholder has been designed to comply fully with the standards set by IEC publication 65, paragraph 11, and also with VDE spec. 0860. All live parts are protected from being accidentally touched, even in the event of an active-neutral transposition, and irrespective of finger placement when the fuse in changed. Most European and other overseas countries now require the use of fuseholders complying with this standard in all new equipment.

The Rafi holder is designed for 20mm long / 5mm diameter cartridges rated at up to 6.3A / 250V. The case is moulded from black Duroplast, and mounts in a 16.5mm diameter keyed panel cutout.

Enquiries to E. S. Rubin & Co Pty Ltd, 73 Whiting St, Artarmon, NSW 2064.

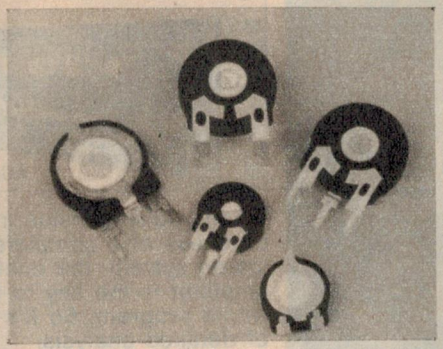
Indoor TV Aerial



Goldring Sales & Service (NSW) Pty Ltd handle this intriguing indoor TV aerial, the "Apollo" type Z1901. Made in Western Germany, it has independently steerable VHF and UHF elements. Stated UHF gain is from 3 to 8dB, output Z 300 ohms.

Trim pots from Spain are fully enclosed

Local manufacturers and hobbyists alike have given a warm reception to the range of fully enclosed trimmer potentiometers made in Spain by Piher S.A. and marketed here by General Electronic Services.



Designated the "PT" series, the pots are available in two basic sizes, with diameters of 15mm (PT15) and 10mm (PT10). Vertical and horizontal mount versions are available in each size, together with fluted wheel and shaft versions.

Both the body and rotor of the pots are of moulded plastic, with silver plated metal inserts. The patented construction gives full enclosure of both the carbon track and the rotor, protecting them from dust, dirt and solder flux as well as mechanical damage. The normal rotor mouldings have a screwdriver slot on both sides.

The rotor uses a dual wiper design which is claimed to reduce contact resistance to less than 1pc. Operating torque is rated at 50-200pcm. Maximum dissipation of the 10mm unit is 200mW, and of the 15mm unit 250mW, with working voltage ratings of 150V and 200V respectively. Normal resistance range is from 50 ohms to 10M. The products conform closely to DIN standard 41450 and IEC 190.

Further information on the Piher range of trimmer pots, slider pots, carbon film resistors and ceramic trimmer capacitors is available from General Electronic Services Pty Ltd, 114 Alexander St, Crows Nest, NSW 2065. The products are generally available through most wholesalers.

6-inch midrange speaker from Plessey

A new release from Plessey Rola is the C6MR, a specially designed 6 inch midrange loudspeaker intended to form part of a high-quality three way system. A likely application is for upgrading existing single speaker and two-way systems.

The C6MR is very suitable for use with any combination of the other Plessey Rola loudspeakers. It has a very smooth midrange response with sharp roll-off at frequencies below and beyond. The frame is solid to prevent interference from other units mounted in the same enclosure.

Power handling capacity is 20W effective when correctly fed. Fundamental resonance is 500Hz, and response is ±6dB from 450Hz to 6.6kHz. VC diameter is 1 inch.

Crossover and enclosure details are available on request from Plessey Rola offices in both Sydney and Melbourne.

Select Sansui stereo amplifiers for...

Superior design
Superb engineering
Sparkling performance


AU-555A

When you're considering the purchase of a complete new stereo system, the control amplifier is the key to the whole program. So it's worthy of detailed analysis.

There are six audibly superior control amplifiers in the Sansui range . . . from 30 watts RMS to 100 watts RMS. All feature *all-silicon* transistor design — and distortion is considerably *less* with Sansui control amplifiers, as output stages are semi-complementary Darlington designs without *input* or *output* transformers. Transformers have always caused some distortion problems in amplifier design — but not with Sansui!

The startling difference you will notice with any Sansui stereo amplifier is the *tonal quality* and the obvious *dynamic range*. In every price bracket your new Sansui amplifier sounds like a much more expensive unit. These are not idle words. In the review of the least expensive Sansui amplifier, the AU-101, a leading Australian journal said . . . "*. . . few amplifiers, regardless of price, give an overall test result as good as this*". Another review said . . . "*. . . better than most other amplifiers at twice the price*".

With those comments made about the AU-101 (recommended price $149) can you imagine how effective the other models in the Sansui range are? With more power and, let's face it, higher price tags?

Let's look at the complete Sansui stereo amplifier range:


AU-505

MODEL	POWER RATING at 8 ohms.	FREQUENCY RESPONSE	REC. PRICE
AU-101	30 watts RMS	20-60,000 Hz. ± 2 dB.	$149
AU-505	50 watts RMS	20-60,000 Hz. ± 2 dB.	$199
AU-555A	50 watts RMS	20-40,000 Hz. ± 1 dB.	$237
AU-666	70 watts RMS	10-40,000 Hz. ± 1 dB.	$325
AU-888	90 watts RMS	10-70,000 Hz. ± 1 dB.	$403
AU-999	100 watts RMS	5-100,000 Hz. ± 1 dB.	$460

IMPORTANT: All prices are recommended prices only. The actual cost can well be less — as trade-in valuations can make a world of difference. See your Bleakley Gray franchised dealer!

Bleakley Gray Corporation Pty. Limited,
28 Elizabeth Street, Melbourne, 3000.
Please send me complete details about the Sansui amplifier Model .....
and the name of my nearest Bleakley Gray dealer.

NAME .....

ADDRESS .....

..... **POSTCODE** .....

Sansui

Sansui Distributors: Australia, excluding W.A.:

Bleakley Gray Corporation Pty. Limited.

Head Office: 28 Elizabeth St., Melbourne, Vic. Tel. 63 8101*. Telex 31904; **Sydney Office:** 177 Salisbury Rd., Camperdown, N.S.W. Tel. 519 5555*; **Canberra Office:** 25 Molonglo Mall, Fyshwick, A.C.T. Tel. 95 2144*; **Adelaide Office:** 301 South Terrace, Adelaide, S.A. Tel. 23 6219; **Brisbane Office:** 3 Prospect St., Bowen Hills, Qld. Tel. 52 7333; **Perth Office:** 27 Oxford St., Leederville, W.A. Tel. 81 4988. **INTERSTATE REPRESENTATIVES: N.T.:** Pfitzner's Music House, Smith Street, Darwin. Tel. 3801. **Tas.:** K. W. McCulloch Pty. Ltd., 57 George Street, Launceston. Tel. 2 5322.

W.A. DISTRIBUTORS:
Atkins Carlyle Limited, 1-9 Milligan St., Perth, 6000. Tel. 22 0191.

Sansui equipment is manufactured by:— Sansui Electric Co. Ltd., 14-1, 2-chome, Izumi, Suginami-Ku, Tokyo, Japan.

BG—SA—1272

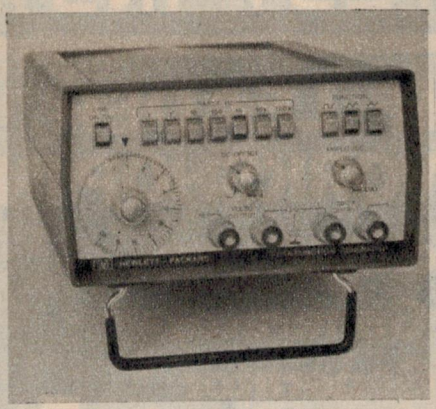
Low cost function generator

Latest function generator from Hewlett-Packard offers sine, square, triangle and TTL compatible pulse outputs from 0.1Hz to 1MHz with low distortion, high linearity and fast risetime.

The new Hewlett-Packard model 3311A Function Generator has a separate TTL compatible pulse output providing current sinking for up to 20 TTL loads in addition to sine, square, triangle and positive pulse outputs. With a risetime better than 25ns, the TTL output is useful for checking logic breadboards or as a synchronisation signal.

In addition an external VCO input is provided for phase-locked loop and swept frequency applications. With the dial set at 1, a linear ramp of 0 to -10V will linearly increase frequency greater than 10 to 1. An AC signal may alternatively be used for frequency modulation.

Seven decades of frequency are covered, selected by pushbuttons: 0.1Hz to 1MHz.



Output is 10V P-P into 600 ohms for sine, square and triangle outputs. A continuously variable attenuator adjusts output over a range greater than 30dB. Sinewave THD at maximum output is less than 3pc, linearity of the triangle output better than 1pc at 100Hz and maximum output.

Price of the model 3311A is $250 duty free, surprisingly low in view of the instrument's features and performance.

Enquiries to Hewlett-Packard Australia Pty Ltd at 22-26 Weir St, Glen Iris, Vic 3146 or branches in Sydney, Adelaide, Brisbane, Perth and Canberra.

Pye UHF Pocketfone

A new addition to the Pye Pocketfone 70 range of lighweight 2-way radios is an FM hand-held single channel unit operating in the UHF band 405-470MHz.

The new unit is fully solid state and is housed in a strong shower proof polycarbonate case. It uses an internal rechargeable 15V nickel-cadmium battery, and has an inbuilt aerial. Controls on the PF5UH are simple: on-off volume and press to talk.

Operation is virtually noise free, with good penetration into buildings and heavily screened areas.

Enquiries to Philips Telecommunications Manufacturing Co Ltd, Clarinda Rd, Clayton Vic 3168, or offices in each state.

LEADER TEST INSTRUMENTS

AUDIO VHF LEADER `L' SERIES MATCHING WORKSHOP INSTRUMENTS

- LBO 311 - 3" Oscilloscope
- LSG 16 - Signal Generator
- LAG 26 - Audio Generator

LBO-311 3" OSCILLOSCOPE

This 75mm (3") oscilloscope meets the requirements for a low cost general purpose instrument for waveform observation up to 1mHz without sacrificing the sensitivity. It has an effective display area of 8x10 div. (1 div. = 6mm).

Recommended for use where elaborate oscilloscopes are not necessary, as in service shops, ham stations and educational institutions.

LAG-26 AUDIO GENERATOR

LAG-26 is a stable generator for testing all types of audio circuits from simple devices to hi-fi amplifiers. Operating controls are functionally laid out for ease in handling. This instrument is well adapted for all round use in servicing and instructional purposes.

LSG-16 SIGNAL GENERATOR

Here is a compact solid state RF signal generator designed for the hobbyist, service bench and technical instruction. The generator is an updated version of the well known LSG-11 signal generator. It is designed specifically for checking and aligning IF circuits and tuners in AM, FM radios and TV sets. The circular calibrated frequency scales insure high accuracy in setting and readout.

AVAILABLE FROM ALL LEADING & ELECTRICAL SUPPLY HOUSES.

FOR MORE INFORMATION CONTACT:

WF WARBURTON FRANKI

- ADELAIDE 56-7333
- BRISBANE 52-7255
- HOBART 23-1841
- MELBOURNE 69-0151
- PERTH 61-8688
- SYDNEY 648-1711

WF2.0491

Tecnico moves

Tecnico Electronics have recently moved into a new warehousing and office complex in Sydney. The new facility provides double the area formerly occupied.

The move has been necessitated by rapid expansion of the Instrument and Components divisions of the company. During 1972, Tecnico acquired agencies for Cam Metric Ltd, Dawe Instruments Ltd (UK), ITT Metrix Ltd of France, Teb-Hubner and Felten & Guilleaume of Germany and Kay Elemetrics Corp of USA. They were also appointed Australian distributors for

Bourns Inc, US manufacturer of adjustable and precision potentiometers.

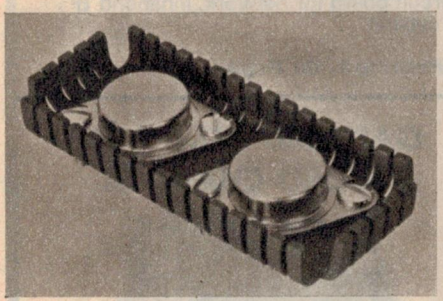
The new premises have a frontage on Premier St, Marrickville, with its own loading dock and customer reception area. The same 'phone number (55 0411) and telex number (AA21490) apply.

Compact heatsink, IC inserting tool

McMurdo Australia have available a new compact heat dissipator for pairs of TO-3 devices, also a locally developed tool for rapid and safe insertion of DIL integrated circuits.

The new dissipator measures 3-3/8in x 1-13/32 x 7/16in and was designed for use on printed wiring boards. Designated the UP10-TO3-2U, it was developed by International Electronic Research Corporation. The size makes it very suitable for most of the standard size plug-in boards used in power supplies and computer equipment.

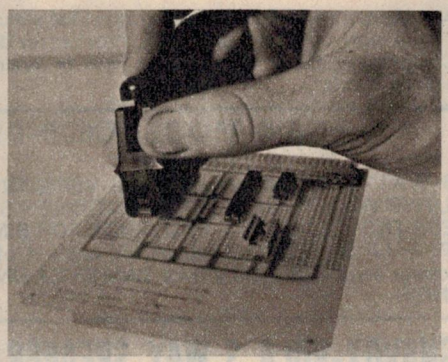
The finger design of the dissipator enhances efficiency in forced air environments by creating turbulence. It maintains the TO-3 pair case rise to 120°C with a dissipation of 36W total (200cfpm). Thermal matching for the pair of devices is also good.



The IC insertion tool has been developed in Australia for inserting DIL devices safely and rapidly into either PW boards or DIL sockets. The two-piece tool is fully insulated and suits both 14-pin and 16-pin devices. The risk of damage caused to the device pins by manual insertion is virtually eliminated.

The tool is designed to pick up the device from a smooth surface, at the same time automatically setting the pin spacing to the standard 0.3in. After insertion the plunger is depressed and the IC is safely mounted.

Further information regarding both products is available from McMurdo



(Australia) Pty Ltd, 17-21 Carinish Road, Clayton, Vic 3168 or 242 Blaxland Road, Ryde, NSW 2112.

In brief . . .

PRECISION CABLE CUTTER

NS Electronics have introduced a new precision cable cutter for use on all types of flat cables. The unit, manufactured by Carpenter Manufacturing of Manlius, NY can handle cable thicknesses from 0.002" to 0.25" without damage to conductors or insulation.

NS Electronics, Stud Rd & Mountain Highway, Bayswater 3153.

SOUND LEVEL METER

CHANNEL Electronics of Sussex UK have produced a lightweight, inexpensive sound level meter to cover the range from 26dBa to 120dBa. Modern techniques of production ensures stable and reliable operation. The UK price of £34.60 should ensure ready application in the Motor Sport, construction and Local Authority fields.

CHANNEL ELECTRONICS (SUSSEX) Ltd, Cradle Hill Industrial Estate, Seaford, Sussex.

GAS DISCHARGE DISPLAYS

A new range of 1/3" and ½" planar gas discharge displays has been announced by Sperry Information Displays. The new read-outs feature high speed, high readability, long life and compatability with MOS-LSI logic. The provision of keep-alive cathodes reduces the re-ionization time and improves the performance at low temperatures and low ambient light levels.

The seven segment displays are available in one and

NEW ALL-TRANSISTOR STEREO AMPLIFIERS WITH IN-BUILT A.M. TUNER ULTIMATE IN DESIGN— LONG DEPENDABILITY using all silicon transistors 50 WATTS RMS

SPECIFICATIONS
POWER OUTPUT:
25 watts per channel R.M.S. Total output 50 watts R.M.S. 8 Ohms.
FREQUENCY RESPONSE:
20 cycles to 40,000 ± 1db.
HUM & NOISE:
Aux. 70db. Mag. 60db.
INPUT SENSITIVITY:
Mag. 2mv. Aux. 250mv.
EQUALISED:
Mag. RIAA.
TONE CONTROLS:
Bass 50 c/s ± 13db. Treble 10kc/s 15db.
HARMONIC DISTORTION.
Less than 0.5 per cent.
LOUDNESS CONTROL:
50 c.s 10db.
SCRATCH FILTER:
(high filter) at 10kc/s 5db.
RUMBLE FILTER:
(low filter) at 50 c/s 5db.
PROVISION FOR TAPE RECORDER.
Record or play-back with din plug connector. Tape monitor switch.
SPEAKER SWITCHING:
Two sets of speakers can be connected and selected by switch on front panel, they can also be driven together.
HEADPHONES:
Headphone jack is situated on front panel.
DIMENSIONS:
16½in X 11in. deep. Weight lbs.
TUNER:
This unit incorporates a transistor tuner with a coverage of 530 to 1,600 K. C. Calibrated dial available for all states.
POWER SUPPLY.
Regulated power supply with switching protection for output transistors.
SEMICONDUCTORS.
30 silicon transistors plus 7 diodes.

Amplifier Only
Model C.700
$139.00 Plus Freight
Cabinet Extra

Provision For 4 Channel

$159.00 Plus Freight
(cabinet extra)

Model C700-T (with Tuner)

Model C700

All units wired with sockets & control for simulated 4 channel only requires the addition of two extra speakers, also output socket for decoder.
Cabinets for above amplifiers in Teak or Walnut Oiled Finish with matching metal trim $10.00 extra.

NEW MODEL C600-T 36 WATTS RMS

36 WATT (18 watts per channel) VERSION OF THE C700-T AMPLIFIER WITH TUNER, SPECIFICATIONS AS FOR THE C700-T BUT LESS THE FOLLOWING: PROVISION FOR SIMULATED 4 CHANNEL, SPEAKER SWITCHING (outlet for one set of speakers only) & tape monitor switch. SUPPLIED IN TIMBER CABINET TEAK OR WALNUT FINISH.

$149
FREIGHT EXTRA

— NEW MAGNAVOX-ROLA 3 WAY SPEAKER SYSTEM —

FREQUENCY RESPONSE 35Hz to 25KHz
POWER HANDLING CAPACITY 30 WATTS R.M.S.

DRIVE UNITS:
Magnavox 8-30 High Performance 8in Bass Unit • Magnavox 6.J — 6in Mid Range Speaker • Rola X30 High Fidelity Dome Tweeter
COMPLETE SYSTEM in 1.6 cubic ft. cabinet. In Walnut or Teak Veneer (Size 24" x 15½" x 11").
$69.50 ea. ***Packing & Freight Extra.***

SPEAKER KIT: (less cabinet) comprising 1 8-30 speaker, 1 6J speaker, 1 Rola X30 dome tweeter, 1 1mh. inductance, 1 8mfd. & 1 4mfd. polyester condenser, 1 3" & 1 6" tube, 1 printed circuit board for network, innabond & speaker silk, plans for cabinet.
$36.00 ***Reg Post & Packing $2.00 Extra.***

SPECIAL HI-FI SYSTEM FROM CLASSIC

PIONEER SA-600 AMPLIFIER OR KENWOOD KA 4002

MAGNAVOX ROLA
3 WAY SPEAKER SYSTEM AS ADVERTISED ABOVE
$460.00
FREIGHT & PACKING EXTRA

GARRARD ZERO 100 RECORD CHANGER

Fitted with Shure Magnetic Cartridge & Diamond Stylus. Supplied with timber base & perspex cover.

COMPLETE 25 WATT STEREO SYSTEMS FROM $199.00

CLASSIC RADIO

245 PARRAMATTA RD, HABERFIELD 2045
PHONES 798 7145, 798 6507

NEW PRODUCTS

a half, two, two and a half and three digit units, supplemented by a plus-minus sign, over-range 1 and extra decimal point in the half digit units.

NS Electronics, Stud Rd & Mountain Highway, Bayswater 3153.

HYBRID CATV AMPLIFIERS

MOTOROLA have a new series of hybrid wideband amplifier modules designed for CATV applications. The hermetically sealed units use push-pull circuitry to provide linear amplification over the range 40MHz to 300MHz, with a 24 volt supply.

The three modules are; MHW560 with a power gain 14.5dB for low noise front end applications, MHW561 for line extender output stages and the MHW 562 for the output stages of trunk and bridger amplifiers. Motorola claim a MTBF of 800 years for the transistor metalization in these devices.

MOTOROLA Semiconductor Products, 37 Alexander St, Crows Nest 2065.

NEW CONSOLE AMPLIFIER

The Marantz Company of USA have brought out a new 60 watt per channel amplifier with very comprehensive control facilities. These include access to the pre-amp outputs and power amp inputs to permit the addition of accessory equaliser devices. Slider type tone controls are fitted together with tape monitoring and headphone jacks. The model 1120 may be either rack mounted or fitted in the walnut case available. The Australian price is given as $649.

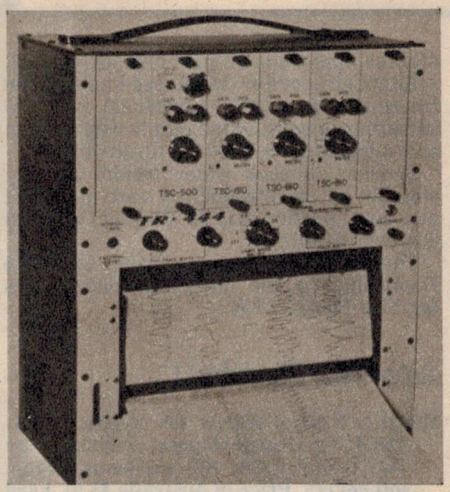
AURIEMA (A / ASIA) Pty Ltd, 549 Pittwater Rd, Brookvale.

ELECTRONIC TEACHING AIDS

Tecquipment Ltd, based in Nottingham UK, have introduced a series of eight experiments for use in schools and technical colleges. Each experiment is fitted in a sloping top case in a two tone finish and is supplied with the appropriate printed wiring boards, transistors and thermistors. The experiments include the display of device characteristics, the effects of temperature and bias, the efficiency of different classes of operation, AC and DC amplifiers and oscillator circuits. Some of the experiments require the use of other test equipment normally found in a school laboratory.

H. B. Selby & Co Ltd, 352-368 Ferntree Gully Road, Notting Hill 3168.

FOUR CHANNEL RECORDER



A new four channel portable chart recorder has been released by Techni-Rite. It covers the range from DC to 100Hz with inkless, rectilinear recording, eight chart speeds and optional marker provision. A choice of plug-ins with a range of sensitivities from 50uV per division to 10mV per division with 50mm chart width per channel gives the user a wide range of applications.

DC Industries, 32 Smith Street, Collingwood 3066.

PRECISION PRE-AMP

National Semiconductor has introduced the LM121 / LM121A family of precision pre-amplifiers for use ahead of operational amplifiers for greater DC accuracy. With correct offset nulling, thermal drift can be better than 0.2uV / °C, an improvement over many chopper stabilised amplifiers. The low bias current permits the use of higher source resistances.

NS Electronics, Stud Rd & Mountain Highway, Bayswater 3153.

PEOPLE

Hy-Q Electronics have appointed Mr Guy D. Thornton as Marketing Manager of the quartz crystal manufacturing operations. Mr Thornton replaces Mr Tom A. Dineen who has retired from the company.

BOOKS & LITERATURE

Digital basics

DIGITAL ELECTRONICS, by Brice Ward. Published by Tab Books, Blue Ridge Summit, Pennsylvania, 1972. Soft covers, 138 x 216mm, 288pp, photographs and diagrams. Price in Australia $7.40 (hardbound $11.20).

A basic introduction to the concepts of digital electronics, rather similar in fact to the "E-A" handbook of the same name. There is a little less emphasis on basic theory, and a little more on advanced logic configurations, but otherwise the approach is along similar lines. This being the case, it is perhaps understandable that as the author of the "E-A" handbook I can find little to criticise the present book in terms of overall treatment!

Like our own book it is strongly practical in orientation, written with the aim of helping the reader to grasp the concepts of digital circuit operation through experiment, not just by poring over printed exposition and diagrams. It uses practical circuits for explanation throughout the text, and describes both simple experiments and a home-built logic trainer unit at the end.

Although in one or two places I believe the treatment is a little superficial and unsatisfying, generally the text is well written and adequately served by illustrations.

In short, a book which would be very suitable as an introductory text in digital concepts, particularly in conjunction with our own handbook.

The review copy came from Grenville Publishing Co, the Australian distributors for Tab Books. (J.R.)

Model Control

MODEL CAR RACING BY RADIO CONTROL by George Siposs. Published by Tab Books, USA. 137 x 216mm, 224pp, soft covers. Price in Australia $4.95, hard covers $8.70. Profusely illustrated with photos and line drawings.

This book would appear to be aimed almost exclusively at the American market, which would tend to limit its loeal appeal. Most of the equipment described is of ready-made commercial origin which makes the construction of model cars mainly a kit exercise. There is a chapter on the FCC regulations covering model control but this situation would have to be checked for compliance with Post Office Regulations in Australia.

A great number of the photographic illustrations are rendered almost useless by very muddy printing in our review copy, which came from Grenville Publishing Co. (N.J.M.)

FET handbook

FIELD EFFECT ELECTRONICS, by W. Gosling, W. G. Townsend and J. Watson. Published by Butterworth and Co (Publishers) Ltd, London, 1971. Hard covers, 225 x 148mm, 364pp, many illustrations. Price in Australia $25.60.

A comprehensive, thorough and up-to-date treatment of the theory and applications of field effect transistors and associated technology. The authors are academics at the Swansea college of the University of Wales, and have written the book for final year undergraduate students in electronics engineering. It would also be of considerable value for practising circuit designers, technicians and advanced amateurs.

The chapter headings read as follows: 1 — Introduction; 2 — The Junction FET; 3 — The Insulated-Gate FET (MOST); 4 — Noise in Field-Effect Devices; 5 — FET Characteristics; 6 — Single Stage Amplifiers; 7 — Unipolar / Bipolar Amplifiers; 8 — AF Amplifier Topics; 9 — Direct-Coupled Amplifiers; 10 — Choppers and

Analog Gates; 11 — The FET as a Variable Resistor; 12 — HF Amplifiers and Frequency Conversion; 13 — Integrated Circuits; 14 — The Silicon Monolithic IC; 15 — The Photo-FET.

The text is written in clear, concise language, is well served by illustrations, and is very readable. Each chapter ends with a list of suggested references, while the book itself ends with the usual topic index.

In summary, I can only agree with the claim made in the sleeve notes for the book, that it is the most complete text currently available on field effect devices. Not cheap, but a very valuable book despite this.

The review copy came from the local office of the publisher, who advises that copies should be in stock at all major bookstores. (J.R.)

Radio topics

AMATEUR RADIO TECHNIQUES, by Pat Hawker, G3VA. Published by the Radio Society of Great Britain, 35 Doughty Street, London, WC1N 2AE, 1972. Soft covers, 184mm x 242mm, 256pp, large number of circuits and some diagrams. Price in UK £1.60.

This is the Fourth Edition of this now very popular publication. In line with the usual course of events, this new edition is somewhat larger than its predecessors, with much new material added in the main, towards the end of each chapter.

The material in Amateur Radio Techniques has been drawn mainly from Technical Topics, contributed monthly to "Radio Communication" by Pat Hawker. Some additional material by the same author is also included. The chapter on Semiconductors is particularly worthy of mention. In it is a wealth of information in easy to read form and for this information alone, the book is well worth while.

However, in spite of my previous remark on the semiconductor material, the main purpose of this book is one of "ideas" rather than a text book; it must contain many hundreds of interesting ideas. To give some idea of the type of subject matter, here is a list of the contents. 1 — Semiconductors, 2 — Components and Construction, 3 — Receiver Topics, 4 — Oscillator Topics, 5 — Transmitter Topics, 6 — Audio and Modulation, 7 — Power Supplies, 8 — Aerial Topics, 9 — Fault-Finding and Test Units. In addition, there is an Appendix giving a list of IFs of many commercial receivers. A comprehensive index is also included.

Readers particularly interested in amateur radio and who do not already have a previous edition should lose no time in obtaining a copy of this new edition. For those who do own a previous edition, perhaps it would be wise to have a look before investing in another one. However, I feel sure that the extra information now offered is well worth the modest outlay.

Our copy came direct from the publisher but copies should be available through local booksellers by the time this appears in print. (I.L.P.)

Literature briefs

COPPER SURVEY

The Copper And Brass Information Centre has published a 22 page brochure illustrating the indispensable role played by copper and copper alloys in all aspects of the electrical industry, from generation and distribution to consumer and communication applications. The growth of copper usage in Australian electrical industries is emphasised by the fact that the consumption of copper in this field has reached 60,000 tons annually. Other literature covering the engineering properties of copper and its alloys is available including a comprehensive booklet covering American and British wire gauges published by the US National Bureau of Standards.

TWO NEW DRAFT STANDARDS

The Standards Association of Australia is seeking comment on three new draft standards of interest to the electronics industry. DR72193 covers standardisation of item designations for electrical and electronic components, with particular application for diagrams, catalogues and technical manuals. The second draft, DR72194, relates to fixed polystyrene film dielectric capacitors rated at less than 6300V for telecommunications and related equipment.

Comment on these drafts should reach the head office at 80 Arthur St, North Sydney 2060, not later than 28 February, 1973.

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SONY Cassette Deck from $131 or $1.60 weekly

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HEAT SINKS. Finned type. Size 6 ½" x 2". Ready drilled to accept either 2 x TO66 or 1 x TO3 Power transistors. **50c.** each or **2** for **90c.** Post 25c.

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EVERYTHING IN ELECTRONICS

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HEAD OFFICE & M.O. DEPT.: 1st FLOOR, SUITE 2, 164-166 REDFERN ST., REDFERN, N.S.W. 2016

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HOURS OF TRADING.
Mondays to Wednesday & Friday: 9 a.m. to 5.30 p.m. Thursdays: 9 a.m. to 7.30 p.m. Saturday: 8.30 a.m. to 1 p.m. Sundays: **OUR DAY** of **REST . . .**
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All the ingredients for a 9 Transistor Radio . . . **LOOK WHAT YOU GET**
1 Transistor type twin-gang Variable capacitor.
1 5000 ohm miniature switched potentiometer with spindle.
2 Silicon signal Diodes.
9 NPN & PNP Moulded Transistors.
6 Miniature Electrolytic capacitors.
3 I.F.T.'s (A.M. Kit).
1 Oscillator Coil.
1 Wound Ferrite Aerial.
1 Miniature Driver Transformer, 1 Miniature Output Transformer.
1 Miniature Extending Aerial.
Buy these components anywhere & they will cost you approximately $13.50. PLEASE NOTE OUR PRICE FOR THE LOT . . . **ONLY** $7.50 + 25c post. These COMPONENTS are ALL new stock and not rejects & guaranteed by us . . .
RUSH YOUR ORDER NOW . . . Only limited quantities available.

WATCH OUR PRICES GO DOWN . . . NOT UP.
BZY88 Series Zener diodes 50c each.
2N3055 Power Transistors 2 for $2.75.
2N3054 Power Transistors 2 for $2.35.
BC108 6 for $1.95. BC107 6 for $1.95.
BC109 6 for $1.95. 2N5459 F.E.T. 2 for $1.95. 2N5485 F.E.T. 2 for $2.25. 2N3638 Transistors 3 for $1.95. TC1102 (STC) 400v 6 amp Triac & Trigger Diode . . . complete kit $2.75
EACH KIT ABOVE PLUS 10c POST.

M.S. COMPONENTS . . . First in the field again with the **'JET MAIL-ORDER SERVICE'.** We guarantee that ALL orders received are PROCESSED & DISPATCHED in One Hour.

COMPONENT PACS

COMPAC A real money-saver. Guaranteed value over $10. Consisting of complete etching kit, 4 pieces of P.C. board, 4 trimpots, 20 assorted poly & styrene capacitors, 30 assorted ¼ & ⅛th watt resistors, 10 assorted electrolytic capacitors & 4 spring loaded terminals. Only $6.00 + 50c post.
VARIPAC 6 assorted Wire-wound potentiometers by Colvern & I. R. H. These normally cost $1.50 ea. Sure-fire value at only $3.00 + 20c post.
SEMIPAC 50 assorted NPN, PNP silicon & germanium transistors, signal & high-speed switching diodes and 3 watt Zener diodes. Normal value of these would be in the region of $25. Only $10.00 + 25c post.
CAP-PAC 50 assorted High grade Electrolytic capacitors. All useful values and no junk. From 1 md to 10,000 mfd, 3 v to 50 v. Fantastic value. $10.00 + 40c post.
BEYPAC Consisting of 50 assorted BEYSCHLAG resistors. One of the best resistors in the world. A special offer of ⅛th, ¼ & 1/3rd. watt resistors in 1% & 2% tolerance. You cannot buy these under 15c each. Only $2.50 post free NSW. Other states 25c post.
SWITCHPAC 8 SUPERIOR MADE SWITCHES BY **ARROW** consisting of the following: — 2 S.P.D.T. Toggle switches, with moulded dolly's. 2 D.P.S.T. Toggle switches with metal dolly's, 2 Push-button switches, normally open, panel mounting type, 2 Push-button switches, normally closed, panel mounting type. A total of 8 switches normally valued at $4.50. Our price $2.00 + 25c post.
ALL THE COMPONENTS offered above are guaranteed NEW & UNUSED.

EXTENDING AERIALS. Transistor or Television type. Sturdily made & finished in heavy chrome. Extends to 36" & down to 6". Swivel base. **95c** each - or 2 for **$1.75** plus 25c. post.

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AUSTRALIAN TELEVISION STATIONS

ACT

Area	Call	Channel Polarity
Canberra	ABC	3-V
	CTC	7-V

New South Wales

Area	Call	Channel Polarity
Sydney	ABN	2-H
	ATN	7-H
	TCN	9-H
	TEN	10-H
Bega-Cooma	ABSN	8-V
Broken Hill	ABLN	2-V
	BKN	7-V
Central Tablelands	ABCN	1-V
	CBN	8-V
Central Western Slopes	ABQN	5-V
	CWN	6-V
Grafton-Kempsey	ABDN	2-H
	NRN	11-H
Illawarra	WIN	4-H
	ABWN	5A-H
Manning River	ABTN	1-V
	ECN	8-V
Mungindi	ABMIN[1]	—
Murrumbidgee	ABGN	7-H
	MTN	9-H
Newcastle-Hunter	NBN	3-H
	ABHN	5-H
Richmond-Tweed	ABRN	6-H
	RTN	8-H
SW Slopes and E Riverina	ABMN	0-H
	RVN	2-H
Upper Namoi	ABUN	7-H
	NEN	9-H

Victoria

Area	Call	Channel Polarity
Melbourne	ATV	0-H
	ABV	2-H
	HSV	7-H
	GTV	9-H
Ballarat	ABRV	3-H
	BTV	6-H
Bendigo	ABEV	1-V
	BCV	8-V
Goulburn Valley	ABGV	3-V
	GMV	6-V
Latrobe Valley	ABLV	4-H
	GLV	10-H
Mildura	ABMV	4-H
	STV	8-H
Murray Valley	ABSV	2-V
Upper Murray	ABAV	1-H
	AMV	4-H

Queensland

Area	Call	Channel Polarity
Brisbane	TVQ	0-H
	ABQ	2-H
	BTQ	7-H
	QTQ	9-H
Alpha	ABAQ[1]	—
Augathella	ABAAQ[1]	—
Barcaldine	ABBQ[1]	—
Blackall	ABBLQ[1]	—
Cairns	ABNQ[2]	9-H
	FNQ[2]	10-H
Charleville	ABCEQ[1]	—
Clermont	ABCTQ[1]	—
Cloncurry	ABCLQ	7-H
Cunnamulla	ABCAQ[1]	—
Darling Downs	ABDQ	3-H
	DDQ	10-H
Dirranbandi	ABDIQ[1]	—
Emerald	ABEQ[1]	—
Goondiwindi	ABGQ[1]	—
Hughenden	ABHQ	9-H
Julia Creek	ABJQ	10-H
Longreach	ABLQ[1]	—
Mackay	ABMQ	4-H
	MVQ	6-H
Mary Kathleen	ABMKQ	9-H
Miles	ABMSQ[1]	—
Mitchell	ABMLQ[1]	—
Morven	ABMNQ[1]	—
Mount Isa	ABIQ	6-H
	ITQ	8-H
Richmond	ABRDQ	6-H
Rockhampton	ABRQ	3-H
	RTQ	7-H
Roma	ABRAQ[1]	—
St George	ABSGQ[1]	—
Southern Downs	ABSQ	1-H
	SDQ	4-H
Springsure	ABSEQ[1]	—
Townsville	ABTQ	3-H
	TNQ	7-H
Wide Bay	ABWQ	6-V
	WBQ	8-V
Winton	ABWNQ[1]	—

South Australia

Area	Call	Channel Polarity
Adelaide	ABS	2-H
	ADS	7-H
	NWS	9-H
	SAS	10-H
Ceduna	ABCS[1]	—
Central East	ABRS	3-V
South East	ABGS	1-H
	SES	8-H
Spencer Gulf North	ABNS	1-V
	GTS	4-V
Woomera	ABWS[1]	—

Western Australia

Area	CALL	Channel Polarity
Perth	ABW	2-H
	TVW	7-H
	STW	9-H
Bunbury	BTW	3-H
	ABSW	5-H
Carnamah	AB—W[1]	—
Carnarvon	ABCNW	7-H
Central Agricultural	ABCW	4-H
Dampier	ABDW[1]	—
Esperance	ABEW[1]	—
Geraldton	ABGW	6-H
Kalgoorlie	ABKW	6-H
	VEW	8-H
Mingenew	AB—W[1]	—
Moora	ABMW[1]	—
Norseman	ABNW	7-H
Port Hedland	ABPHW[1]	—
Southern Agricultural	ABAW	2-V
	GSW	9-V
Southern Cross-Bullfinch	ABSBW[1]	—
Three Springs	AB—W[1]	—

Tasmania

Area	Call	Channel Polarity
Hobart	ABT	2-H
	TVT	6-H
	ABKT	11-H
King Island	ABNT	3-H
North Eastern Tasmania	TNT	9-H

Northern Territory

Area	Call	Channel Polarity
Darwin	ABD	6-H
	NTD	8-H
Alice Springs	ABAD[1]	—

TRANSLATOR STATIONS

New South Wales

Area	Parent Station	Channel Polarity
Armidale	NEN-9	1-H
	ABUN-7	4-H
Batemans Bay-Moruya	ABWN-5A	9-H
	WIN-4	11-H
Bega	WIN-4[1]	6-H
Bonalbo	ABRN-6	3-V
	RTN-8	5-V
Bourke-Brewarrina	ABQN-5[1]	4-H
Cobar	ABQN-5[1]	2-V
	CWN-6	10-V
Cooma	ABSN-8	0-M
	CTC-7	10-V
Eden	WIN-4[1] (via Bega)	3-H
	ABSN-8	5-H
Glen Innes	ABUN-7	0-H
	NEN-9	3-H
Gloucester	ABTN-1[1]	0-H
Goulburn	ABC3	0-V
	CTC-7	10-V
Inverell	ABUN-7[1]	2-H
	NEN-9	10-H
Kandos-Rylstone	ABCN-1	0-V
	CBN-8	10-V
Kyogle	ABRN-6	3-V
	RTN-8	5-V
Lithgow	ABCN-1	5-V
	CBN-8	6-V[3]
Mudgee	CWN-6	9-V
	ABQN-5	11-V
Murwillumbah	RTN-8	5-H
Nyngan	ABQN-5[1]	3-V
Portland-Wallerawang	ABCN-1[1]	0-H
	CBN-8[1]	4-H
Snowy Mountains (Khancoban)	AMV-4	10-H
Upper Hunter	ABHN-5[1]	2-H
	NBN-3	10-H
Walcha	NEN-9	1-H
	ABUN-7	5-H
Wollongong, North West	WIN-4[1]	3-H

TRANSLATOR STATIONS
Continued

Area	Parent Station	Channel Polarity
Victoria		
Alexandra	ABGV-3	5-H
	GMV-6	10-H
Bright	AMV4[1]	11-H
Eildon (via Alexandra)	ABGV-3	1-H
	GMV-6	3-H
Myrtleford	ABGV-3	2-H
	AMV-4	9-H
Nhill	BTV-6	7-V
	ABRV-3	9-V
Orbost	ABLV-4	2-V
Portland	ABRV-3 (via Warrnambool)	4-H
	BTV-6	11-H
Swan Hill	BCV-8	11-V
Warrnambool-Port Fairy	ABRV-3	2-V
	BTV-6	9-V
Queensland		
Blackwater Bluff	RTQ-7	10-H
Bowen	TNQ-7	1-H
	ABTQ-3	5-H
Cardstone Village	TNQ-7[1]	5-V
Collinsville	ABMQ-4	8-H
	MVQ-6	11-H
Cracow	RTQ-7	5-H
Gladstone	RTQ-7[1]	5-H
Gympie	WBQ-8	1-V
	ABWQ-6	4-V
Monto	ABWQ-6	1-V
	WBQ-8[1]	5-V
North Townsville	TNQ-7	9-H
	ABTQ-3	10-H
Toowoomba	DDQ-10	5-H
South Australia		
Bordertown	ABS-2	2-V
Cowell	ABNS-1	6-V
	GTS-4	8-V
Keith	ABS-2	4-V
Port Lincoln (via Cowell)	ABNS-1	3-H
	GTS-4	5-H
Western Australia		
Kambalda	VEW-8	3-H
Katanning	ABKW-6	5-H
	ABAW-2	4-V
Wagin-Narrogin	BTW-4[1]	11-V
	BTW-4[1]	6-H
	ABAW-2[1]	8-H
Tasmania		
Derby	TNT-9	11-H
Gowrie Park	TNT-9	1-H
	ABNT-3	11-H
Maydena	TVT-6	8-H
Queenstown-Zeehan	ABT-2	4-H
	TVT-6	8-H
Rosebery-Renison Bell (via Queenstown)	ABT-2	1-H
	TVT-6	10-H
St Marys-Fingal Valley	ABNT-3	1-V
	TNT-9	11-V
Savage River-Luina (via Waratah)	ABNT-3	4-H
	TNT-9	7-H
Smithton (via Stanley)	ABNT-3[1]	8-V
	TNT-9[1]	11-V
South Launceston	ABNT-3	1-H
	TNT-9	11-H
Stanley	ABNT-3	1-V
	TNT-9	6-V
Strahan (via Queenstown)	TVT-6	3-H
	ABT-2	10-H
Strathgordon	ABT-2	5-H
	TVT-6	8-H
Swansea-Bicheno	TVT-6	8-6
Taroona	TVT-6	8-H
Waratah	ABNT-3	2-H
	TNT-9	10-H

NEW ZEALAND TV STATIONS

Area	Call	Channel
Auckland		
Auckland	AKTV	2
Translators and repeaters		
Central Northland	AKTV	3
Eastern Bay of Plenty	AKTV	6
Northern Northland	AKTV	6
Southern Northland	AKTV	5
Waikato-Bay of Plenty	AKTV	1
Wellington		
Wellington	WNTV	1
Translators and repeaters		
Central East Cost	WNTV	2
East Cape	WNTV	4
East Egmont	WNTV	9
Gisborne-Wairoa	WNTV	1
Hawkes Bay	WNTV	6
Manawatu	WNTV	2
Nelson-Motueka	WNTV	4
Oakura-West Taranaki	WNTV	4
Taranaki	WNTV	6
Tolaga Bay	WNTV	5
Wairarapa	WNTV	7
West Egmont (Opunake)	WNTV	5
West Egmont (Pukeiti)	WNTV	7

Area	Call	Channel
Christchurch		
Christchurch	CHTV	3
Translators and repeaters		
Kaikoura	CHTV	8
South Canterbury	CHTV	4
Dunedin		
Dunedin	DNTV	2
Translators and repeaters		
Clinton	DNTV	5
Southland	DNTV	1

Frequencies

Channel	Frequency MHz	Channel	Frequency MHz
1	44-51	6	188-195
2	54-61	7	195-202
3	61-68	8	202-209
4	174-181	9	209-216
5	181-188		

OVERSEAS TV STATIONS

For general information of overseas television stations, reference can be made to the "World Radio & TV Handbook". Revised each year, this book is available through most large technical booksellers or through our short-wave correspondent, Mr Arthur Cushen.

AUSTRALIAN REPEATER STATIONS

Location	Call	Channel Polarity
Queensland		
Weipa	WEQR	7-H
Western Australia		
Cockatoo Island (via Koolan Island)	CKWR	9-H
Dampier	HDWR[7]	7-H
Karratha (via Dampier)	HDWR[7]	9-H
Koolan Island	CKWR	7-H
Mount Tom Price	HTWR	7-H
Mount Nameless	HTWR	9-H
Paraburdoo	HTWR	11-H
Newman	NEWR	7-H
Northern Territory		
Groote Eylandt	GEMR	7-H

Notes

[1] Projected station.

[2] Temporary station.

[3] Frequency is modified by minus 1MHz.

[4] Temporary station. Its operation will be reviewed after the Cairns full power station has opened.

Will ultimately use channel 4. Channel 5 has been allocated on a temporary basis subject to withdrawal on 12 months notice.

[6] The polarity of transmission is horizontal for Swansea and vertical for Bicheno.

[7] When the national television station to serve the Dampier area is established, the licences for these repeaters will be withdrawn.

The polarity of transmission is indicated by the initial letter:

H Horizontal

V Vertical

M Mixed horizontal and vertical. Used for the national translator station at Cooma to enable viewers to obtain best reception in the most economical manner.

A television translator station is a relatively low-powered device which receives signals from a parent station or another translator station, and re-transmits these signals on a different channel without substantially altering any characteristic of the signals other than their frequencies and amplitudes.

A television repeater station is a low power station which transmits only programs pre-recorded on magnetic tape. Repeater stations are permitted to originate local audio-only station identification and emergency announcements.

All stations with a call sign commencing with AB belong to the national television service provided by the Australian Broadcasting Commission. All others are privately owned commercial television stations operated under licences granted by the Postmaster-General.

All call signs finish with a letter which indicates the state or territory in which the station is located. The letters are allocated:

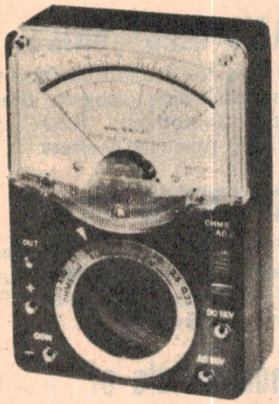
C Australian Capital Territory
D Northern Territory
N New South Wales
Q Queensland
S South Australia
T Tasmania
V Victoria
W Western Australia

Frequencies

Channel	Frequency MHz	Channel	Frequency MHz
0	45-52	6	174-181
1	56-63	7	181-188
2	63-70	8	188-195
3	85-92	9	195-202
4	94-101	10	208-215
5	101-108	11	215-222
5A	137-144		

NEW RH (Radio House) RANGE OF MULTIMETERS

MODEL RH-60 $29.00 Packing & Postage $1.00



50,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.
Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 25uA, 5mA, 50mA, 500mA.
Resistance: 10K, 100K, 1M, 10M.
Decibels: —10 +62dB.
Accuracy: DC ±3 p.c., AC ±4 p.c. (of full scale).
Batteries: Two 1.5V dry cells. Overload protected.

MODEL RH-100 $39.75. Postage $1.00

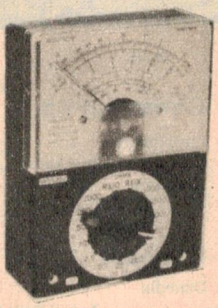
100,000 Ohms per Volt DC 10,000 Ohms per Volt AC

• Overload protected by dual silicon diodes • Double-jewelled ± 2 per cent meter • ± 1 per cent temperature-stabilised film resistors • Polarity changeover switch • Mirror scale • Instructions for operation with circuit diagram.

SPECIFICATIONS:
DC Volts: 0.6, 3, 12, 60, 300, 600, 1200 (100,000 V).
AC Volts: 6, 30, 120, 300, 1200 (10,000 V).
DC Current: 12A, 300A, 6mA, 60mA, 600mA, 12 amps. AC Current 12 amps.
Resistance: 20K, 200K, 2M, 20M.
Decibels: — 20 to +17, 31, 43, 51, 63.
Accuracy: DC ±3 per cent. AC ± 4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA, "Eveready" 915.

"HANDYMAN" RH150 $11.50

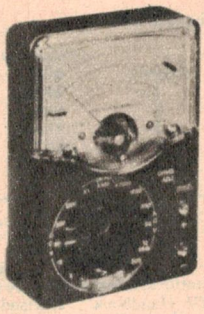
CHECKED PACKED & POSTED $12.00



Pocket-size 3¼" x 4½" x 1¼". Instruction sheet and circuit.

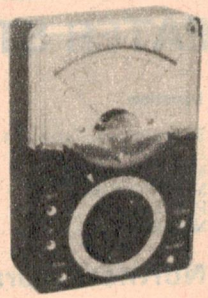
SPECIFICATIONS:
DC Volts: 2.5, 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: .1, 25, 250mA.
Resistance: 20K and 2M.
Decibels: —20db, +62dB, 0.7KHz.
Capacitance: .0001, .01, .0025, .25uF

MODEL RH-20 $15.00 Packing & Postage 75c



20,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.
Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current, 50uA, 25mA, 250mA.
Resistance: 7K, 700K, 7M.
Decibels: —10, +22 (at AC/10V) + 20, +36 (at AC/50V). Upper frequency limit uKHz.
Batteries: Two 1.5V dry cells.
With overload protection $18.00.

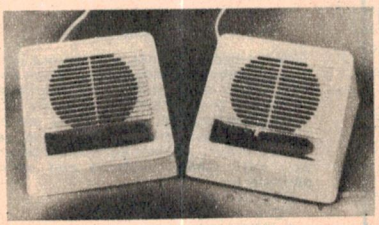
MODEL RH-80 $20.00 Packing & Postage 75c



20,000 Ohms per volt DC.
10,000 Ohms per volt AC.
Specifications:
DC Volts: 0.5, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 50uA, 5mA, 50mA, 500mA.
Resistance: 5K, 50K, 500K, 5M.
Decibels: —10dB + 62dB.
Accuracy: DC 3pc.
AC 4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA, "Eveready" 915.

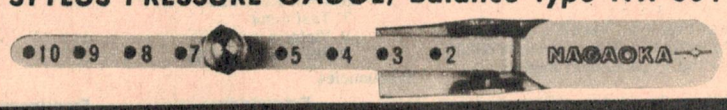
• Overload protected by dual silicon diodes • Double-jewelled ± 2 per cent meter • ±1 per cent temperature-stabilised film resistors • Mirror scale.

INTERCOMS



"Edison satellite" 2-station $9.75.
"Homer" 2-station $12.75.
"Homer" 3-station $21.75
"Sunlite" 4-station $29.75.
Postage 75c

STYLUS PRESSURE GAUGE, Balance type NW-501



$1.50 Posted

RADIO HOUSE PTY. LTD.

306-308 PITT STREET 61-3832 26-2817 760 GEORGE STREET SYDNEY. 211-0171

AMATEUR BAND NEWS & NOTES

by Pierce Healy, VK2APQ

The Amateur and Civil Defence

Civil Defence provides a ready made opportunity for amateurs to cooperate with a national organisation in providing a service to the community and at the same time enhance the image of amateur radio.

Charles Allen, Chief Signal Officer, New South Wales Civil Defence Organisation, prepared the following notes for the guidance of amateurs. Charles is also an active amateur (VK2ALC) and has been guest speaker at several WIA meetings.

In each state there is a Wireless Institute Civil Emergency Net (WICEN), at the disposal of official authorities as a viable communication unit, if and when required. There are , however, many instances where individual amateurs, whether WIA members or not, may assist their own local Civil Defence Organisation.

These notes will give readers an insight into the aims and objects of the CDO.

An amateur's knowledge and station are always available for service to his community. In Australia, Civil Defence is also available for service to the community, in both war and peace. To introduce amateurs to Civil Defence the following notes have been prepared.

Civil Defence is a voluntary, public organisation, assisted by Government (Local, State and Federal) to protect life and property in times of major disaster. Civil Defence is concerned with saving life; caring for the injured; feeding, clothing and accommodating the homeless; maintaining the morale and spirit of the people, and keeping the economy and the government functioning.

The Civil Defence concept is well proven. Throughout the world it has stood the test of war and emergency, both at local level and on a national scale

Its aim, common to all countries, is:

To provide co-ordinated, efficient and prompt use of all resources against an enemy attack or natural disaster, to minimise loss of life, damage to property and interruption to the national effort.

The danger of an enemy attack on Australia at present is remote. However, international situations seldom stand still. Thus, it is wise to maintain a measure of preparedness. It is for this reason that Australia has adopted a policy of Civil Defence.

War is not the only eventuality. Year after year, our country is subjected to floods, fires, cyclones, local accidents and even earthquakes. These take their toll of life, property and natural resources. The costs frequently run into millions of dollars. We cannot afford this loss especially when an effective Civil Defence Organisation (with other agencies) can do so much to protect and mitigate. Over recent years the Civil Defence Services have more than proved their worth. Given the support of good citizens, they will go on doing so.

Civil Defence organisation in Australia, is based on local government areas. A chain of control is established by grouping local government areas into Regions and Zones.

The overall control of Civil Defence for each state is exercised from a State Headquarters, with a Director appointed by the State Government.

At the commonwealth level, the Director is concerned in organising assistance for a stricken area from other states and commonwealth resources.

Each local government area establishes a Local Civil Defence Organisation, with a Controller appointed by Council. Region / Zone Controllers are usually appointed by the Director in each State.

At each control level the organisation provides officers or teams under the following headings: Warden, Rescue, Medical and Health, Welfare, Supply and Transport, Scientific, Engineering, and Signals.

A reliable communications network is essential in an emergency. The Signals Service is responsible for:—

- Liaison with the Australian Post Office on provision of telephone and telegraph facilities which form the basis of the communications system.
- Establishing and operating signal centres at each headquarters, including local headquarters.
- Establishing and operating alternative means of communication in the event of interruption to the normal system, e.g. radio, field cable, and despatch rider or runner.
- Provision of mobile communications.

The primary radio mode in the larger cities is VHF FM. Investigations are proceeding into UHF. The VHF / UHF plan in some states does not envisage remote controlling in any form, the resultant restricted service area being accepted and taken into account in planning.

When VHF is not appropriate, HF SSB is used. 100 watt PEP multi-channel sets are provided at Region / Zone Headquarters, other base and mobile stations are 25 watt PEP. USB only is used.

Aerials on HF are usually ½ wave dipoles, fed via a toroid BALUN with RG 58 CU co-axial cable. For mobile use helical whips are most generally used.

The main difficulties on HF have resulted from the choice of frequency. The channels allocated are in the 3.7MHz band and, in some months during the middle of the day, some dircuits present difficulties. In Western Australia and New South Wales an additional allocation of 7.3MHz has relieved the situation during daylight hours.

In many areas amateur radio clubs are affiliated with Civil Defence and, in addition, many individual amateurs are valued members of their local Civil Defence Organisation. VK2OK is a Local Controller as was VK2HC until quite recently.

In the event of an emergency in which amateurs could help, the best arrangement would be for the Chief Signal Officer, or his equivalent at State Headquarters, to contact the State WICEN Co-ordinator. There may not be time to do this, in which case the Civil Defence Signal Officer wanting assistance should contact the nearest amateur radio operator / s.

WIRELESS INSTITUTE ACTIVITIES

JOHN MOYLE NATIONAL FIELD DAY

The WIA invites amateurs and short-wave listeners to take part in the contest, held annually, in memory of a great supporter of the institute and amateur radio, the late John Moyle, VK2JU. John passed away not long after returning to Australia after representing Australian amateurs at the ITU conference at Geneva in 1959.

Peter Brown, VK4PJ, WIA federal contest manager, comments on the contest in general. The NZART field day will be held on the same weekend. Although the New Zealand contest permits operation only on the 3.5MHz and 7.00MHz bands some activity between field stations across the Tasman should result.

Societies in the United States, England, Germany and Japan, have been offered certificates for stations who make the highest number of contacts with VK portable or mobile stations during the contest.

It is expected that the provision for multiple contacts between VHF mobile stations will increase the activity among VHF operators.

About 50 letters were received from participants in the 1972 Remembrance Day Contest, many with suggestions for improvement. Comments on the JMNFD contest will be welcome.

This contest may be either an individual effort or a group effort. There are two divisions, one of 24 hours continuous operation and one of 6 hours continuous operation, within the 26 hours available.

Date and Time:—

From 0600 GMT, 10th February, 1973 to 0800 GMT, 11th February, 1973.

Objects:—

Operators of portable or mobile stations within VK call areas will endeavour to contact other portable, mobile, or fixed stations in VK, ZL and foreign call areas.

Rules:

1. In each division, 24 hour and 6 hour, the operating period must be continuous.
2. In each division there are seven sections.
   a. Portable fixed field station, phone.
   b. Portable fixed field station, CW.
   c. Portable fixed field station, open.
   d. Portable fixed field station, open, multiple operator.
   e. Mobile transmitting, phone.
   f. Fixed transmitting stations.
   g. Receiving of portable and mobile stations.
3. Contestants must operate within the terms of their licence.
4. A portable fixed field station must operate from a power supply which is not used to move a vehicle or which is not connected to a permanent installation.
5. A mobile station must be installed in a vehicle.
6. No apparatus used by a field station may be set up on a site earlier than 24 hours prior to the contest.
7. All amateur bands may be used but no cross-band operation is permitted.
8. Cross mode operation is permitted.
9. All operators of a multiple operator station must be located within a half mile diameter circle.
10. For each transmitter of a multiple operator station a separate log shall be kept with serial numbers starting from 001 and increasing by one for each successive contact. All logs of a multiple operator station shall be submitted under whose call sign the transmitters are working. No two transmitters of a multiple operator station are permitted to operate on the same band at the same time.
11. Amateurs may enter for any section.
12. An amateur may enter for both mobile and portable field fixed station sections, but a separate log must be forwarded for each section which must be for one continuous period in each case, ie operators must not keep alternating between mobile and portable.
13. Entrants must call "mobile" or "portable" as the case may be, eg "VK3XX mobile" or "VK5ZZ portable" if a fixed field station.
14. Mobile and portable stations may contact each other as well as contacting fixed transmitting stations.
15. The usual method of giving "RS" or "RST" reports followed by serial numbers starting with 001 shall be adopted.
16. Scoring: For portable and mobile stations.

Portable or mobile stations outside the entrant's call area; 15 points

Portable or mobile stations within entrant's call area; 10 points

Fixed stations outside the entrant's call area; 5 points

Fixed stations within entrant's call area; 2 points

Scoring: For fixed stations.

Portable or mobile stations outside entrant's call area; 15 points

Portable or mobile stations within the entrant's call area; 10 points

17. Mobile operators may contact the same mobile station repeatedly provided that two full hours has elapsed after the previous contact.
18. Operation via active repeaters or translators is not allowed for scoring purposes.
19. All logs shall be set out under headings of

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown, NSW 2200.

date / time, band, emission, call sign, RST sent, RST received, points claimed, list of contacts in numerical order.

A quarto front sheet is to show the following information:—

Name.....

Address.....

.....

Division.....

Section.....

Call sign.....

Points.....

Call sign of other operators

.....

.....

Location .....

Operating times. From..... To.....

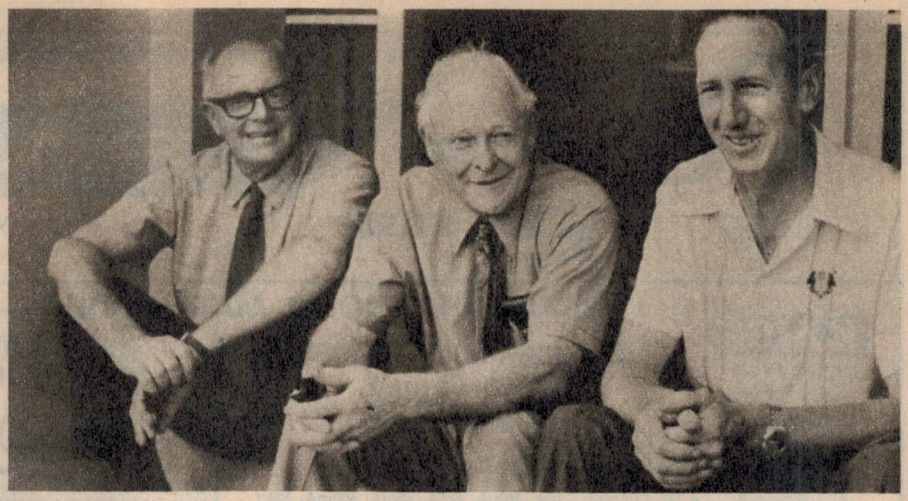
I hereby certify that I have operated in accordance with the rules and spirit of the contest. Signed.....

Details of equipment used,

.....

.....

20. Certificates will be awarded to the highest scorer in each section of the 6 hour and the 24 hour division, provided that there is a minimum of three logs submitted in that section. The 6 hour certificate cannot be won by a 24 hour entrant.



Three well known Newcastle amateurs relaxing at a recent Hunter Branch field day. From left to right: John Trail, VK2XQ; Chris Cowan, VK2PZ; and Harold Whyte, VK2AHA. Judging from their expressions, the field day must have been a complete success!

22. All CW CW contacts count double. Refer sections b, c, and d.

Written comments from entrants will be received with interest. The decision of the Federal Contest Manager is final and no disputes will be entered into.

Receiving Section:

This section is open to all short-wave listeners in VK call areas.

The rules shall be the same as for transmitting stations but may omit the serial numbers received.

Logs must show the call sign of the portable or mobile stations heard, the serial number sent by it and the call sign of the station being contacted.

EXAMPLE OF VICTORIAN SWL's LOG:

DATE / Time GMT	Band MHz	Call sign Heard	RST Sent	Station Contacted	Points Claim
0600	3.5	VK2AA / P	58001	VK3ATL / P	15
0605	3.5	VK3ATL / P	59016	VK5QV	10
0624	7.0	VK2AA / P	579006	VK6VE / P	15
0640	14.0	VK3WW	59010	VK5QV / P	*
0650	52.0	VK3ZZA / M	59007	VK4ZAZ / M	10

* No score (fixed station).

21. Entries must be forwarded in time to be opened on 23rd March, 1973 / Mark envelope "John Moyle Memorial National Field Day". Address entries to:—

Federal Contest Manager
WIA
Box 638, GPO
Brisbane 4001

Scoring will be on the same basis as for transmitting stations. It will not be sufficient to log a station calling "CQ".

For scoring purposes the left hand column of the log example must have only portable or mobile stations.

A certificate will be awarded to the highest scorer of the 6 hour and 24 hour divisions, both individual and club entries.

NEW SOUTH WALES

St George Amateur Radio Society

The St George Amateur Radio Society meets in the Civil Defence Hall, The Mall, South Hurstville, on the first Wednesday of each month at 7.30 pm.

The official circular "DRAGNET" is published monthly and contains reports on club activities and topics of a technical nature.

The club participated in the Scout Jamboree-on-the-Air in October 1972. During eight hours operating at the Sans Souci Girl Guides Hall twelve contacts were made with other groups, including VK9GO at Bougainville.

South West Area Convention

The South-West Zone, NSW Division, WIA, annual convention is set down for the October 1973 holiday weekend. A South-West Zone operator's and short-wave listener's contest will commence on February 1st, 1973 and continue until approximately 14 days prior to the convention.

Contest rules:

Section 1 — To promote activity between stations in area 5 on 3.5MHz and 7.00MHz bands.

To score, an area 5 station must exchange, in the usual form, contest points with another area 5 station.

One contact per band only may be made each day. Each contact will count 1 point.

Double points may be claimed for CW to CW contacts.

Section 2 — SWL contest open to any listener in the Commonwealth.

To score, a listener must log the two area 5 stations in contact and record both contest numbers exchanged by stations.

A certificate and cash prize will be awarded to the winner in each section. The presentation will be made at the convention in October.

In general, area 5 includes the areas in and around Tumut, Tumbarumba, Albury, Deniliquin, Griffith, Temora, Cootamundra and Gundagai.

NSW VHF & TV GROUP

The annual Hoxton Park field day was successful although not as many as usual attended. The 432MHz antenna gain contest was won by John, VK2ZUH with a phased array having an 8dB gain. The wizard of the year prize was won by Mike, VK2ZMR with his counter and programmable Morse code generator.

The official journal of the VHF & TV Group, "Tuned Lines," is published monthly and is available at the monthly meetings held on the first Friday in each month at 14 Atchison Street, Crows Nest.

Details for obtaining the journal by mail may be obtained from the secretary, 14 Atchison Street, Crows Nest, NSW 2065.

VICTORIA

Geelong Amateur Radio-TV Club

Members of the Geelong Amateur Radio-TV Club welcomed WIA federal executive and Victorian division officers to the November club meeting.

Various facets of the WIA at federal and state levels were discussed. Officers who attended were: Michael Owen, VK3KI federal president, Peter Williams, VK3IZ, Victorian division president, Bill Roper, VK3ARZ, editor of the WIA magazine A.R. and Peter Dodd, VK3CIF, federal manager.

During a question and answer session many points regarding the operation of the Institute, the policies of the "A.R." publication committee, the functioning of various zones etc. were thrashed out. All questions were answered to the full satisfaction of those present.

The GARC has invested in a new duplicator for production of its newsletter.

Further details from Bob Wookey, VK31C PO Box 520, Geelong 3220, Vic or phone Geelong 21 2674.

Swan Hill District Radio Club

Visitors to Swan Hill are cordially invited to attend the club meetings. Meetings are on the first Wednesday of every month and an activities night on the third Wednesday of the month. The club headquarters are at the Drill Hall, Gray Street, Swan Hill. Visiting amateurs are invited to check the two meter FM channel B when in the Swan Hill area.

The SHDRC station, VK3BSH, was used recently from the club's stand at the Swan Hill National Show and the Scout Jamboree on the Air.

Coaching classes for the AOCP examination are conducted by VK3AVP / T, VK3ASF and VK3QI.

QUEENSLAND

VK4 State Convention

The 1973 State Convention of the Queensland Division, WIA, will be held on the weekend 6th and 7th October. The venue will be the Ipswich Amateur Wrestling Club hall, Ipswich. Further details will be given nearer the date.

In a letter from Mrs Linda Luther, Hon. Secretary of the Queensland Division was the comment —

". . . advance notice . . . will enable readers of 'ELECTRONICS AUSTRALIA' to make plans for attending the convention . . . we hope to have a record attendance in 1973."

So remember, first weekend in October, rendezvous Ipswich, Queensland.

WESTERN AUSTRALIA

VHF Group

The December issue of the Western Australian VHF Group's "News Bulletin" reports that six metre DX had been particularly good to all states. Also, a number of stations have been heard working through the A-O-6 satellite repeater.

The most effective mode through the satellite is CW with SSB next.

A visitor to the Wireless Hill Museum, was Mr Chas. Sandell of Esperance. It stirred up some nostalgia for him as he had worked at the station for a few years prior to 1920.

Mr Sandell has donated a spark gap disc and a crystal detector made by Telefunken. These were souvenirs from a trip he made with Mawson to the Antarctic in 1911.

VHF Group meetings are held in the Wireless Hill Museum building on the fourth Monday of each month at 8.00pm. Visitors welcome.

Further details from the secretary, Tom Berg, 23 Beach Street, Bicton, 6157.

WIA YOUTH RADIO SCHEME

At the end of the year many YRCS clubs go into recess and news becomes scarce. However, from trends observed towards the end of 1972 it can be expected that many new students will be taking advantage of the clubs during the coming year.

Maitland Radio Club

1972 has been one of the most progressive years for the Maitland Radio Club. Each week saw an increase in members and the enthusiasm of members and their families in the club's social activities remained high.

Congratulations of the City of Maitland were conveyed by the Mayor of Maitland City, Ald Noel Unicomb, to the executive and members of the MRC for a job magnificently carried out for the younger and older people in the area.

The annual meeting and election of officers for the coming year will be held at the club rooms Maize Street, Tenambit, East Maitland.

Westlakes Radio Club

Another club member, Ron Smith, was successful at his first attempt at the August examination. Schoolboy Paul Lorger, who missed out in theory at the February examination, qualified for the AOLCP in August.

The mini field day, on the 25th November, 1972 was very successful and the lighthearted events were enjoyed by all.

Awards to members who distinguised themselves during the year were presented by Geoff Moore, of ABC Radio 2NC "Moore for breakfast" program.

The most outstanding student of the year was judged to be Geoff Brown, VK2BBN who was given the Trevor Harris memorial prize for proficiency in YRCS activities. Geoff presently has the distinction of being the youngest club member and probably the youngest person in NSW to hold the full call sign of the amateur service. The prize was the "RSGB Communication Handbook."

For information on the club write to Eric Brockbank, VK2ZOP, Box 1 PO, Teralba 2284.

YRCS Club Net.

YRCS members with short-wave receivers may hear news about youth radio clubs on the last Sunday of each month at 9.00 am (South Aust) from the WIA station VK5WI, on the 1.8MHz or 7MHz bands.

News of club activities or enquiries about the YRCS should be sent to the — State Supervisor, YRCS, 18 McKinlay Street, Elizabeth Downs, S Aust 5113.

QUARTER CENTURY WIRELESS ASSOC.

On Monday evening, 10th December, 1972 members of the Sydney Chapter of the Quarter Century Wireless Association entertained their wives at a dinner party. The venue was the Royal Automobile Club, Macquarie Street, Sydney. There were 35 present including a visitor, Carl F. Reupsch, WB6YFC and his wife, from San Diego, California.

Membership of the Sydney Chapter, QCWA, is open to those amateurs who have been licensed for 25 years or more.

Full details may be obtained from the president, Harry Caldecott, VK2DA; secretary, Pierce Healy, VK2APQ; or treasurer, Brian Anderson, VK2AND at their call book addresses.

AMATEUR BAND INTRUDERS

Both Radio Peking and Radio Pyongyang. North Korea, have breached international agreement and established stations inside the 80 metre amateur band, 3500 to 3700kHz Radio Peking is intruding on 3640kHz and radio Pyongyang on 3560. As might be expected, both suffer interference from legitimate amateur operation.

NOVEL VHF CONTEST

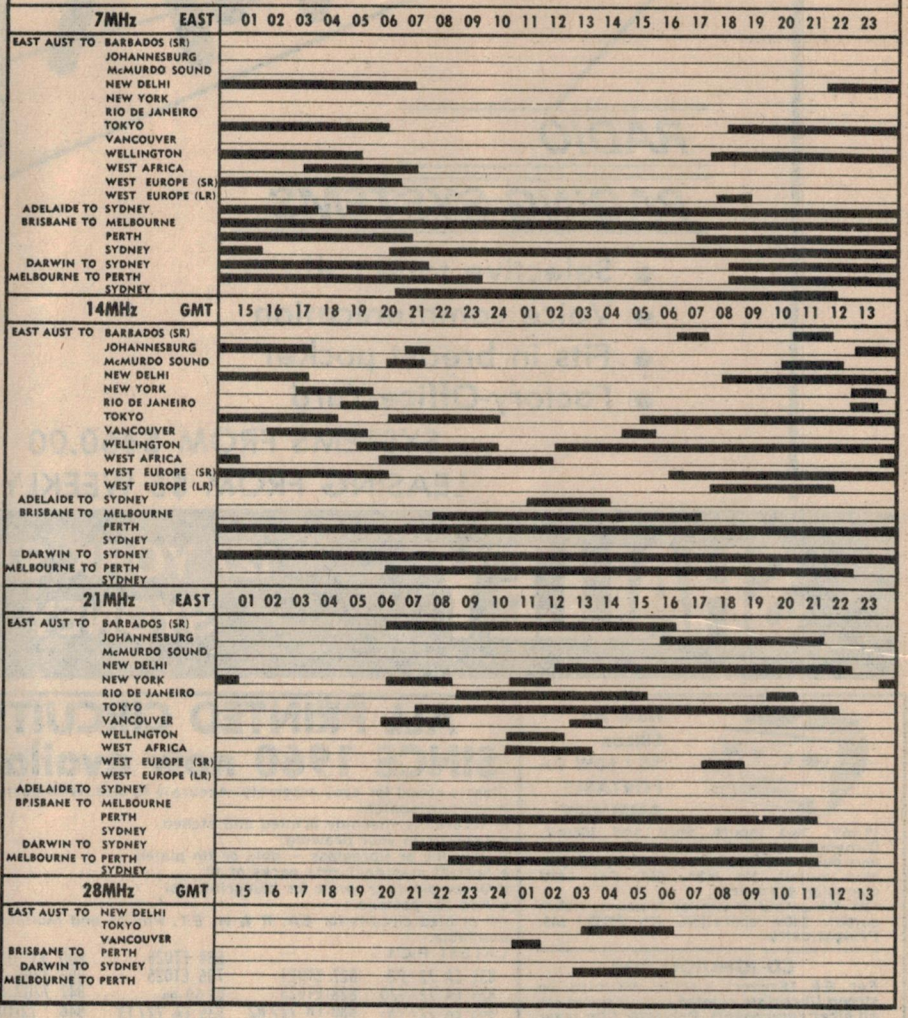
A contest that really proved the capabilities of entrants' receivers for 144MHz was held during a field day in England. The competition was reported in "Radio Communication" October 1972.

About 20 miles away from the picnic location, G8AVG gradually reduced the output of his 144MHz transmitter from a starting level of 5 watts, monitored with his own instruments. The signal levels were also checked by G8ETD nearby.

Eight contestants still read G8AVG at readability 3 strength 3 when his power was reduced to -58dB (G8ETD measured it at -62dB.) This is 5uW into the aerial. The aerial was a Parabeam, while the most successful competitors used halos. Two with 5/8 wavelength whips heard the signal down to 50uW.

IONOSPHERIC PREDICTIONS FOR FEBRUARY

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Commonwealth Bureau of Meteorology. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). They have been prepared for the four most popular amateur bands over a number of interstate and international circuits. Black bands indicate periods when circuit is open. 2.73



DO YOU USE THIS CHART?

The prediction chart on this page is costly to prepare and occupies considerable space. How useful is it to YOU? We are considering discontinuing it, but would like to hear from readers before making a decision. Would you write us a brief note, stating simply whether you find it useful? While we will not be able to answer these, they will all be considered. Thank you.

SOCIAL EXPERIMENT

Two Sussex amateurs, Arthur Campbell, G3PEG, and Bot Street, G8BNO, assisted by other amateurs from the Mid Sussex Amateur Radio Society have shown what amateur radio can do for deprived children. They are in the 10-16 year age group at the Chailey Heritage Craft School.

Regular visits to the school let the lads see amateur radio in operation. Contacts were made on the two and four metre bands with other operators in the district.

Backed by the occupational therapist and the chaplin-warden, it was not long before the youngsters were building two transistor receivers for themselves, using much appreciated bits and pieces donated by various amateurs.

This exercise started in April, 1972, and continued through the year. The organisers would not be surprised if the youngsters graduate to building VHF converters, to listen to and identify those they have met at the school. ("Radio Communication.")

LISTENING TO THE WORLD

by Arthur Cushen, MBE

The National Hellenic Broadcasting Institute at Athens is testing to various parts of the world using 100kW. The higher power and improved reception will be welcomed by Greek speaking residents overseas.

Athens Radio has been testing on several frequencies, using two 100kW transmitters at Aulis. The transmitters are in regular service, use an extensive aerial system, and can be synchronised on one frequency.

The schedule is:

GMT	kHz	Area
0500-0750	6175	Turkey
0800-0950	21610	Australia
1000-1150	17780	C. Africa
1300-1350	15425	Spain
1400-1450	21610	Caribbean
1500-1550	9605	Egypt
1600-1700	6075	Balkan countries
1715-1750	7215	USSR
1800-1850	9520	E. Africa
1900-1950	5960	Europe
2000-2050	7295	Azores
2100-2150	7215	Australia
2200-2250	6075	Japan

For the time being there will be Greek programs with short news bulletins in English, French and German. These transmissions will provide a much needed service to Greek listeners in Australia who, over the years have tried with little success to hear broadcasts from Athens. The broadcast at 2100GMT, on 7215kHz, is giving good reception.

SWEDEN DX CONTEST

This month is the 25th anniversary of Sweden Calling DXers the first session from Stockholm being broadcast on February 28th, 1948. (See January notes.)

To celebrate, Radio Sweden is running a special listeners' contest. As 1973 is World DX Friendship Year, the contest will promote all DX programs and so link Radio Sweden's colleagues together. It invites listeners to listen to DX sessions, in English, from all parts of the world. No entry form is necessary, and the contest period is March 1 to March 7, 1973. The winner will be the listener who has logged the greatest number of DX programs, and noted the greatest number of items in these programs.

The names of stations with DX sessions will be broadcast in Sweden Calling DXers on February 27th and 28th. (Best reception, 0515GMT on 9760kHz.) The contest date has been chosen to include Arthur Cushen's DX World on Radio New Zealand, one of the most difficult sessions to hear in Europe.

The log should be sent, post-stamped not later than March 11th, to: DX Contest, Radio Sweden, S-105 10 Stockholm, Sweden.

NEW PERUVIAN STATION

A new station announcing as Radio Junin has been heard on 5040kHz. This was first observed by Chris Davies of Featherston, NZ, who reports they sign-off at 0645GMT on week days. Our own observations were similar except that on Sunday they were heard to well after 0900GMT.

Junin is a small town in Peru and is also the name of the province. From our records this is the first short-wave station in this area.

UNIQUE INDONESIAN VERIFICATION

A verification has been received from RRI, Manokwari, West Irian, confirming our reception of 8FE5 on 6260kHz.

We first learnt of this verification in a letter from Mr B. F. Bolt, the New Zealand Ambassador at Djakarta, who visited the area recently; the first visit by any diplomat. When he met local dignitories the station manager, Mr Subardi, proudly showed him our reception report on his station which had been received, quite unexpectedly, two days previously. Mr Bolt translated our report and later advised us that a verification was coming and of his own pleasure at the incident.

We have since received the verification, which states that the transmitter had the power of 500W and a delta antenna system facing east and west from a 55ft mast. The station has added a new transmitter recently, on 3345kHz, at 1kW. According to the official RRI list the transmitter heard on 6260kHz is actually allocated 6185kHz, while two call signs are shown, YDU-20 and 8FW51. The schedule is 0300-0600, 0800-1400.

ZAMBIA ON 17895kHz

Radio Zambia has been received with good signals on what appears to be a new high powered transmitter on 17895kHz. At 0500GMT an English news bulletin is broadcast for ten minutes. From 0510 a program of local music and announcements in vernacular is given to 0600. The station interval signal the Call of the Fish Eagle — is given at 0600 and then local programs continue. An announcement at 0500GMT, stated that the next news in English would be at 8 am Lusaka time, (0600GMT). The program did not include this news and it's presumed that this test transmission was part of the local programs.

Radio Zambia is reported by Bob Padula of Melbourne, on 11895kHz at 0500GMT. According to Colin Miller of Johannesburg they are testing a new 250kW transmitter on 11895kHz. They have been heard from 0500GMT to sign-off at 1130GMT and the programs are in English and vernacular.

The address is Zambia Broadcasting Services, Broadcasting House, PO Box RW 15, Lusaka, Zambia.

ENGLISH FROM PRAGUE

The latest schedule from Radio Prague includes many new frequencies. We list below only the English broadcasts.

Europe	
GMT	kHz
1500-1525	6055, 9505
1630-1657	5930, 7345
1900-1927	5930, 7345
2200-2230	6015
South Asia	
0700-0800	6140, 11855, 21575, 21615, 21700
Africa	
1530-1625	6055, 7345, 9605, 11990, 15240, 17840, 21680
1730-1825	5930, 7345, 9605, 11990, 17840
North America	
0100-0157	5930, 6015, 7345, 9540, 9740, 11990
0300-0400	5930, 7345, 9540, 9740, 11990

ENGLISH FROM MOSCOW

Radio Moscow has a daily service to Australia and NZ. The schedule is:

GMT	kHz
1100-1130	12060, 9780, 6000, 629
1130-1200	12060, 9780, 6000, 1250, 629
1200-1230	12060, 9780
1230-1300	12060, 9780, 6000, 1250, 629

LISBON'S ENGLISH BROADCASTS

Radio Portugal carries English programs to most areas. They are well received during our summer months from 0730GMT. The English schedule is:

GMT	kHz	GMT	KHz
0200-0245	11935, 6025	0730-0900	21495, 17880
0345-0430	11935, 6025	1345-1430	21495, 17895
0300-0345	11840	1815-1915	11935
2045-2130	6025	1815-1915	21495

VILA EXTENDS SCHEDULE

Radio Vila, 3945kHz, New Hebrides, is on an extended schedule and now closes at 0900GMT.

The extended schedule has resulted in program changes. English is from 0600 to 0700GMT, pidgin 0700-0745, and French 0745-0900GMT. There is some interference from JOZ5, Tokyo, which uses the same frequency.

AMATEUR BAND INTRUDERS

Both Radio Peking and Radio Pyongyang, North Korea, have breached international agreement and established stations inside the 80 metre amateur band, 3500 to 3700kHz. Radio Peking is intruding on 3640kHz and radio Pyongyang on 3560. As might be expected, both suffer interference from legitimate amateur operation.

AFN TAIWAN

The Armed Forces Network at Taipeh, Taiwan, has been heard on both medium and shortwaves in the past few weeks. The key station on medium wave recently moved from 1560kHz to 1550kHz and is received at 1600GMT. At this time the National Anthems of the Republic of China and the United States are played, followed by station identification. According to this, the power on 1550kHz is 10kW, while repeater stations on 1570 and 1590kHz are both 1kW. Two short-wave frequencies, 7215 and 3390kHz, both use 1KW. The two short-wave frequencies have been noted at 1200GMT. Preceding sign-off at 1600GMT is a five minute news bulletin. All programs are in English.

GUYANA ON 3290kHz

Broadcasts from Georgetown, Guyana are being well received on 3290kHz (10kW) at 0815GMT. The station has a series of guitar musical numbers up to 0842GMT when they play a version of "Puppet on a String". At 0845GMT a full announcement is given and the program commences with request music for Indian listeners, which includes birthday greetings.

The MW service is on 560kHz with a power of 20kW.

The station has an alternative frequency, 5950kHz. This should not be confused with the British Guyana Broadcasting Company, ZFY, which is on 5980kHz around the same time.

Address of the Guyana Broadcasting Service is: 68 Hadfield St, Georgetown, Guyana.

FLASHES FROM EVERYWHERE

UZBEKISTAN: David Foster, of Melbourne, reports that Radio Tashkent has two new frequencies, 6025kHz and 9540kHz. They have also reactivated 9600kHz. These can be heard, in parallel with 11735kHz, with English half hour programs at 1200 and 1400GMT.

THAILAND: The Thai National Broadcasting Station, Bangkok, has been heard at good strength on the relatively new frequency, 9655kHz, with an English announcement at 0930GMT. Prior to this the National Anthem is played and then an announcement in Thai. According to the English announcement the station is on 11905 and 9655kHz from 0930 to 0945GMT. The 11905 channel suffers less interference from nearby stations than does 9655kHz.

GERMANY: Radio Deutsche Welle, Cologne, has introduced special 20 minute broadcasts in German directed to various parts of the world. A service to North America is 1400-1420GMT on 11925, 15245, 17775, and 21540kHz. Bob Padula of Melbourne, Victoria, reports one broadcast was heard 0630-0650GMT on 9545kHz and 11965kHz to Africa and 2330-2350GMT on 6010kHz, 7210kHz, 9630kHz to the Far East.

Recently we verified Radio Bremen on 6190kHz at 0600 and they advised that the power is now 50kW. This at times carries the programs of Sender Freies Berlin.

GABON: Colin Miller also advises that La Vox de la Renovation, Libreville, operates from 0430-0630GMT and 1630-2300GMT on 4777kHz, and at 0630-1630 on 7270kHz, according to a station schedule. The relay station at Franceville has been heard on 4830kHz from 1700 to sign-off at 2300GMT.

MOZAMBIQUE: Radio Club de Mozambique, Beira, has been heard with sign-on at 0430GMT on 6090kHz with a vernacular program. A similar program has been heard at 0600GMT on 9635kHz.

QATAR: According to the Dannish Short-wave Club Bulletin, Qatar is now broadcasting on a new frequency, 6135kHz, with 100kW. The same program is carried on 9570kHz and MW 674kHz. The schedule is 0230-0600, 0900-1930GMT. On Fridays, 0230-0800, 0930-1200, 1300-1930GMT.

INDIA: All India Radio, Delhi, has been heard on a new frequency, 11725kHz. The schedule is 1100 to 1135GMT with English news at 1130. The service to Australia and New Zealand is 2045GMT to 2230GMT on 7260, 9912 and 11740kHz. There is also a service to Africa from 1945 to 2045GMT, on 9595 and 11960kHz.

MEDIUM WAVE NEWS

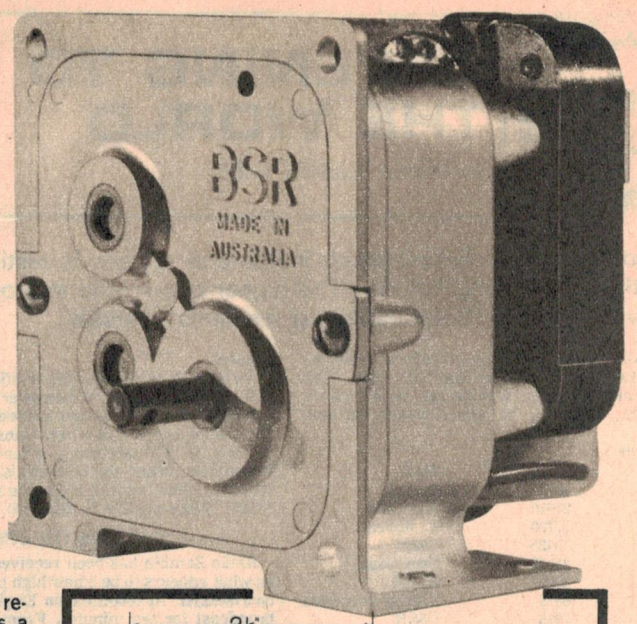
NEW ZEALAND: The Broadcasting Authority has granted a warrant to Avon Broadcasting Company Ltd, for a private radio station for Christchurch. The station expects to operate from next August on 1290kHz with 2kW, and for 24 hours a day.

Readers' notes should be sent to Mr A. Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for Wast, 10 for East, 12 for NZ, plus one if on daylight time.

BSR

SUB-FRACTIONAL HORSEPOWER

Geared Motors



The VPS100 gear box is designed for applications requiring a compact, powerful drive unit and features a die-cast housing, sintered bronze bearings; machine-cut steel gears and pinions plus a non-metallic gear in the first reduction to keep noise to a minimum.

These units are designed to provide greater durability and are particularly suitable where continuous duty is required. All gears are grease lubricated.

They can be adapted to horizontal or vertical mounting and overall dimensions for the VPS100 motor and gear box are 3" x 3" x 3".

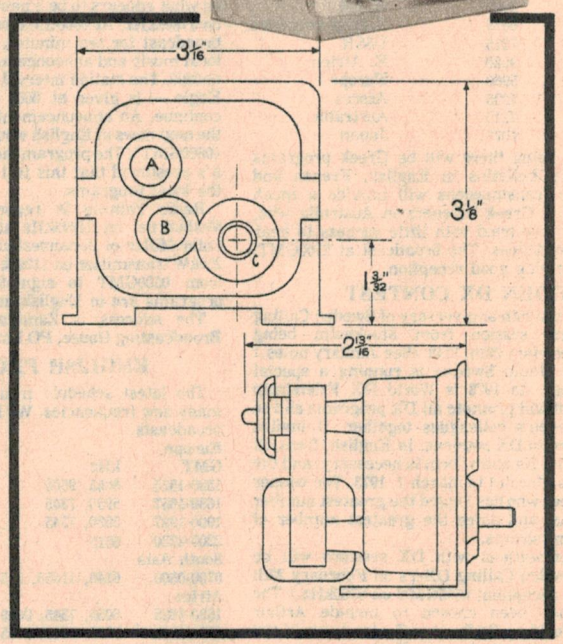
In the standard range, 38 alternative output speeds are available, from as low as 0.9 r.p.m. to 368 r.p.m. (Other speeds are also available but require special gears.)

The wide range of ratios available, together with the choice of 3 output shaft positions, A, B or C, gives great versatility in mounting and speed selection and make the VPS100 adaptable to many applications without expensive re-tooling.

For a unit of such compact dimensions, the torque output is considerable and, when powered by a ½' shaded pole motor, gives, e.g., 46 lb./in. at 0.9 r.p.m.

In those cases requiring still higher torque output and continuous operation a 1" shaded pole motor can be fitted. Alternatively, for intermittent use higher rated ½" or 1" motors are available if required.

In those applications where space is restricted an open gear box, type VPS101, can be provided, having the same general characteristics as type VPS100.



STANDARD BSR GEARED MOTOR VARIATIONS WITH ½" STACK SHADED POLE MOTOR.

VPS 100 A			VPS 100 B		
RPM No. Load	Starting Torque	Output Shaft Position Alt.	RPM No. Load	Starting Torque	Output Shaft Position Alt.
0.9	46 lb. in.	A or C	1	27 lb. in.	A or C
2.7	10.5 lb. in.	B	3	11.5 lb. in.	B
3.7		B	4.5		B
5		B	6		B
5.8	8.5 lb. in.	A or C	7	6.25 lb. in.	A or C
8	8.25 lb. in.	A or C	10	5.75 lb. in.	A or C
9.5		B	15.5	3.5 lb. in.	B
11		A or C	25		A or C
13	4.25 lb. in.	B	30	2.75 lb. in.	B
20		A or C	34.5	30 oz. in.	A or C
24	3.25 lb. in.	B	40		B
28	2.75 lb. in.	A or C	56.5		B
33		B	76	14.5 oz. in.	B
47		B	90	14 oz. in.	A or C
63	1.75 lb. in.	B	124		A or C
74	1 lb. in.	A or C	167		A or C
100		A or C	270	3.75 oz. in.	B
139		A or C	368	3.5 oz. in.	B
223	6.75 oz. in.	B			
304	4.75 oz. in.	B			

PRICE LIST VPS 100 MOTOR/GEARBOX

Quantity	½" Motor	1" Motor	1½" Motor
Single Unit	$10.73	$12.30	$14.79
2-15 Units	9.66	11.07	13.31
16-50 Units	9.12	10.46	12.57
51-100 Units	8.05	9.23	11.09
Over 100 Units	6.97	8.00	9.61

Prices for other than standard output speeds available on application.

Note: Quantity buys apply only to motors/gearboxes with the same specifications.

Prices apply in Australia only.

BSR

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ST. MARYS NSW TELEPHONES 623 0375, 623 0376

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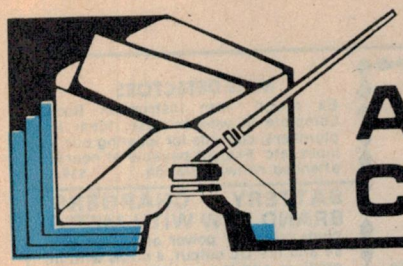

ANSWERS TO CORRESPONDENTS

FREQUENCY CONVERTER: Could you tell me how to convert 50Hz mains to 60Hz, suitable to drive a 60Hz tape recorder from 50Hz mains. (A.B. Auckland N.Z.)

For a start A.B., the equipment you propose would most likely cost more than your tape recorder. The most common method is to use a motor generator set; units of this type were manufactured for American computers used in this country, but this was several years back. Another method would be to divide the mains by 50, multiply by sixty and employ some kind of power amp to increase the power. Your best bet is to merely increase the diameter of the recorder motor pulley (if the unit is belt driven). On the other hand if you do not intend using pre-recorded tapes, the speed change will be of little consequence. If your unit is not a 240V type you will require a suitable transformer also.

DIGITAL CLOCK: I wish to make a digital clock using IC's. Have you published any circuits? What would the oscillator use — an HF oscillator or something along the lines of the Signetics 555 mentioned in November EA? Also, have you any information on "phasing" as used on some pop records, etc? (G.P. Bunbury, WA).

We have not as yet described a digital clock, G.P., although recently we have been giving the idea some thought. The cost of the ICs and readout devices required has tended to make such a project rather unattractive until now, and is still rather discouraging, but perhaps soon we will be able to describe a unit at reasonable cost. Just what type of oscillator it would use is almost impossible to predict — the cheapest way would be to avoid one altogether and use the 50Hz mains as reference, like a normal electric clock. This would save the considerable outlay required for a crystal oscillator and divider chain, yet the accuracy would probably still be satisfactory for most purposes.

We regret that we have no information on "phasing" sound.

AERIAL WIRE COLOUR: I have been reading your magazine for some time now and I reckon your fellows really know what they're talking about. But there was one thing puzzling me in the December 1972 issue. Where you were talking about the Broadcast Tuner you said to use hookup wire of a suitable color for the aerial, and I would like some straight answers to these questions:

1) What is a suitable colour for Broadcast reception?

2) Do you have to use a different colour if you are further from the station?

3) Could you receive short wave if you picked the right colour wire?

Please answer quickly as I will have it built soon and I want to know what colour wire to use. You could put it in the magazine so everyone would know. (J.H., Bendigo, Vic.)

If you are serious J.H. — and several of our staff members have their doubts about this — we can only plead guilty to having accidental published a confusing statement. The author's reference to colour was prompted by the thought, expressed later in the article, that the loop may be conveniently dressed around the walls of a room, and that the colour should be chosen to make it as unobtrusive as possible. This becomes apparent as the article progresses. We feel that it is stating the obvious to explain that the colour of the wire or, more correctly, the insulation around it, has no effect whatsoever on its signal collecting properties.

If, on the other hand, J.H., you were pulling our leg, your point is well taken; the reference to colour was somewhat premature in the overall discussion.

HISTORY OF MAGAZINE: In a recent issue I noticed an answer to a reader enquiring about the history of "Wireless Weekly" and "Radio in Australia", on which you appeared to be rather vague. Perhaps I can help, as I was employed by Wireless Weekly in the 1925-26 era.

At that time the paper was prepared in a building approximately opposite the police station in Regent Street, Sydney, and printed by the Land Newspaper about 100 yards up Regent Street towards Redfern. The editor was A. W. Watt, advertising manager Jack Reidy, circulation manager Mr Latimer, and part-time technical editor Mr Slade of Slade's Radio. During my stay with the paper it was acquired by Publicity Press, then sold in a short space of time to Farmer and Co (2FC). The editorial staff was re-housed in Williamson House, later to become the Theatre Royal.

At this stage I left the magazine and "went bush", as things were becoming pretty grim and leading up to the depression. On my return to Sydney in 1927-28 I found that Wireless Weekly had been acquired by Sun Newspapers and housed in Martin Place in the old Sun building since replaced by the Government Insurance Office. The editor was then G. Blunden, who became a prominent war correspondent and author. The rest I think you know. I don't remember much about "Radio in Australia", except that like many other such publications it met with an untimely demise due to unsufficient reader and advertising support.

Incidentally have you published any notes or errata regarding the Solid State Voltmeter of December 1968? I am having trouble with mine, and I note for example that on p47 of the article you state that the 7.5M input divider resistance is made up from a 3.3M, a 2.7M and a 1.5M in parallel! (W.H.V., Chatswood, NSW)

Many thanks for the historical information, W.H.V. It was certainly interesting to learn that our predecessor Wireless Weekly began its life in Regent Street, and was in fact printed in the building which now houses our company's main office.

The only published note regarding the SSVM is that regarding the use of 2N5459 devices in place of the MPF105, which you have apparently already seen. We had not noticed the error about the divider resistors, but perhaps you will agree that the error is so obvious that a correction is scarcely necessary. If you care to write and give more detail regarding the trouble with your SSVM, we will try to offer any help we can.

110 SHORT-WAVE RECEIVER: I would like a project reprint of the EA 110 Short-wave Receiver, described in August 1970. It was stated in this article that it was proposed to extend and modify the design to permit SSB and CW reception, improve the AGC system, and add an RF stage. Has this been done and, if so, in what magazine did the description appear? (R.M., Brisbane, Qld.)

As with all our projects, reprints for the 110 Receiver are available, price 50c (File No. 2/SW/54). The improvements promised in this article were finalised, and the result was the 160 Receiver, December 1970, File No. 2/SW/55. Thank you for your compliments regarding the magazine.

TRANSIENTS, ARTICLES: Why is so much effort ploughed into Dolby noise reduction and low wow and flutter figures, while we are plagued by transients and control tones in our amplifiers? It is so important to remove a few dB of hiss when we tear our hair out over the kids next door switching the fluorescent lights on and off? Another gripe: Why do you and some other publications print such pitifully uninteresting articles like "Video LP Disc Uses Laser Pickup"? Again, "The Infra-red Universe" and "Testing Tyres with Holograms"? I suggest that your staff put some more

"ELECTRONICS AUSTRALIA" INFORMATION SERVICES

As a service to readers "Electronics Australia" is able to offer: (1) Project reprints, metal work dyelines, photographs, printed wiring patterns and other filed material to do with constructional projects and (2) A strictly limited degree of assistance by mail or through the columns of the magazine. Details are set out below:

PROJECT REPRINTS: These cost 50c per project. Reprints are available for all projects, but no material can be supplied additional to that already published. Reprints can be supplied more speedily if they are positively identified and not accompanied by technical queries. Material not on file can normally be supplied in photostat form at 30c per page.

SUBSCRIPTIONS, BINDERS, HANDBOOKS etc: These are handled by separate departments. For fastest service, send separate orders to the departments concerned.

PHOTOGRAPHS, METAL WORK DRAWINGS: Original photographs are available for most projects. Price: $1 for 6in x 8in glossy print. Metal work dyelines are available for most projects. Price: $1 These show dimensions and positions of holes and cut-outs, but give no wiring details.

PRINTED WIRING PATTERNS: We can supply transparencies, actual size, positive or negative, as specified Price: 50c. We do NOT deal in manufactured boards. These are available from advertisers.

BACK NUMBERS: As available. On issues up to six months, face value, Seven months to 12 months, face value plus 5c. Thirteen months or older, face value plus 10c. Postage and packing, 10c per issue extra. Please indicate if a PROJECT REPRINT may be substituted if the complete issue is not available.

REPLIES BY POST: These are provided to assist readers encountering problems in the construction of our projects published within the last two years. Note, particularly, that we cannot provide lengthy answers, or undertake special research or modifications to basic designs. Charge: 50c. Inclusion of an additional fee does not entitle correspondents to special consideration.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee and may be answered in the magazine at the discretion of the Editor. Technical queries will not be answered by interview or telephone.

COMMERCIAL EQUIPMENT: "Electronics Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-disposals equipment etc. We are therefore not in a position to comment on any aspect of such equipment.

COMPONENTS: "Electronics Australia" does not deal in electronic components. Prices, specifications, etc should be sought from appropriate advertisers or agents.

REMITTANCES: These must be negotiable in Australia, and should be made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque, endorsed with a suitable limitation.

POSTAGE & PACKING: All charges shown include postage and packing, unless otherwise specified.

ADDRESS: All requests for data and information should be directed to the Assistant Editor, "Electronics Australia", Box 157, Beaconsfield 2015.

(2/73)

SOUND PROJECTORS

Cinevox Prefect and Harmour and Heath 16mm in good working order. 240v operated, complete with speaker and amplifier.

from $115.00

CIRCULAR SLIDE RULE

3¾in diameter. Will do the same work as the conventional slide rule. Instruction book included.

from $1.60 each
Post 12c.

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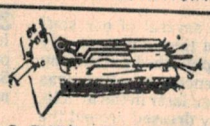

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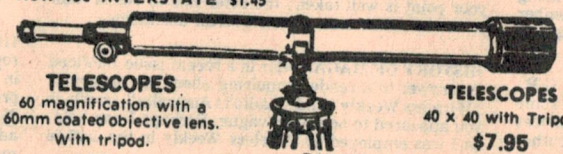

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SORRY, NO C.O.D.

time into good construction articles. (N.H., Frankston, Vic.)

You sound thoroughly fed up with control tones — reacting to the same circumstances which caused us to stir the whole subject some years back. There has been a lot of discussion since and an awareness among supply authorities that control tones had to be used with more discretion. Certainly the problem appears to have diminished since then, to judge by the relative lack of complaints. Maybe you need a line filter to cope with tones and transients alike. Maybe your equipment is unduly sensitive to line impulse noise.

As far as articles are concerned, not everyone judges magazines on the sole basis of constructional articles — thank goodness! A significant proportion of our readership likes to be kept up to date on what is happening in the world of electronics. Hence the articles on developments, products and activities. We try to maintain quality in our projects but we certainly do not have as an objective an all-constructional magazine!

NEW ZEALAND PROBLEMS: The comments expressed by Mr Banks in his letter (September 1972, p47) are right on target. I also have been frustrated in attempting to find components exotic to this country. Some of our dealers go well out of their way to search for equivalents, though the time involved must be very annoying. I would like to add a further plea to your manufacturers to include in their advertisements the New Zealand agent where these exist.

I too have taken EA over many years, but have overcome the storage problem by tearing out articles and circuits of interest and filing these in a box; now on wheels as I can no longer lift it. At this point I must protest at your relapse into bad habits. For several years you have never started a new article on the back of a page on which a previous article finished. For this you earned my gratitude, as it makes it possible to pull out every article complete. But over the last few months you have neglected this service, and I have had many agonising decisions to make, as to which article to keep and which to discard. Could you please revert to your previous and much appreciated good habit.

I have one further request; an article on impedance. What makes an output or input of high or low impedance, and why impedances must be matched.

In spite of the criticism, I assure you that EA is the best publication in the field. (A.W., Oamaru, N.Z.)

Thank you for your comments, A.W., which we hope will be noted by those most concerned. As we think you appreciate, there is little more that we can do, and our comments in the September Forum would still apply.

We agree that storage of magazines can be a problem, and we note your approach to it. As regards the location of projects material on opposite sides of the one page, we can assure you that any "good habits" which we apparently followed were quite unconscious; we have never made a conscious effort in this regard, simply because we were unaware of such a need on the part of readers. But, in any case, we fear that there is little we can do about it. Laying out a magazine is such a complicated process, with so many other requirements having to be satisfied, that a requirement of this type would come a poor last. This is unfortunate, but it is a fact of life.

Thank you also for your suggestion for an article on impedance. We will certainly keep this one in mind.

CARBON BLOCK MICROPHONE: In your November 1969 issue you published a short historical article about a simple intercom using a homemade microphone. I wonder if a speaker could be substituted for the telephone receiver. Also I would like to know if an amplifier stage would be practicable. Another request: have you published a circuit for a multiple band receiver equipped for AM, CW and SSB reception on HF or VHF bands? (A.B., Lyndhurst, Vic.)

The carbon block microphone shown in the historical article would require an impedance matching transformer to operate with a loudspeaker, and even if you went to that trouble, we doubt if the microphone would provide enough power to drive the speaker successfully. An audio amplifier would solve the problem, but by the time you go to all that trouble you may as well start with a modern microphone or use a small loudspeaker as an intercom microphone. If you just wish to experiment with the carbon block type, a high impedance earphone would probably be satisfactory.

Your second request is rather a large order for one receiver. The 1970 All Wave Two (File No. 4/TR2/5), which is a simple beginner's set, covers from the broadcast band to 30MHz. Our 130 Receiver/Tuneable IF covers from 3.5MHz to 7.5MHz and, with converters, it will be capable of receiving the 52MHz and 144MHz bands as well as the 14,21 and 25MHz bands. It can be used for SSB and FM, as well as AM and CW. File numbers for the basic 130 Receiver are 2/SW/62 and 2 SW 63. Reprints are available.

Notes & Errata

PRODUCT REVIEW: In a review of the Audiosound "Haffner" loudspeaker in the November 1972 issue, reference was made to certain research work into loudspeaker performance by Mr A. N. Thiele. This is in error. The work referred to was described in the Proceedings of the IREE, June 1970: "Assessment of Loudspeaker Quality" by I. H. Shearman.

PLAYMASTER 134 PA AMPLIFIER: (June 1972, File No 1 PA 29): The Phono 1 input lead to the board diagram on page 47 has the earth braid and active lead transposed. Also, the A&R transformer type PT6413 has only one 32V winding. A bridge rectifier must be used for this transformer.

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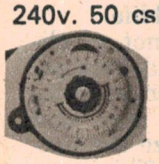

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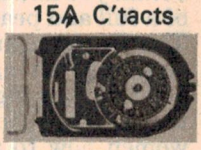

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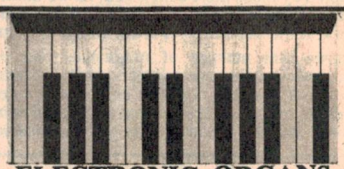

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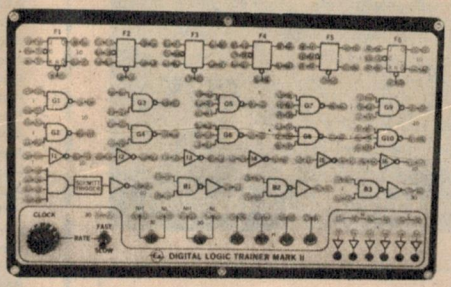

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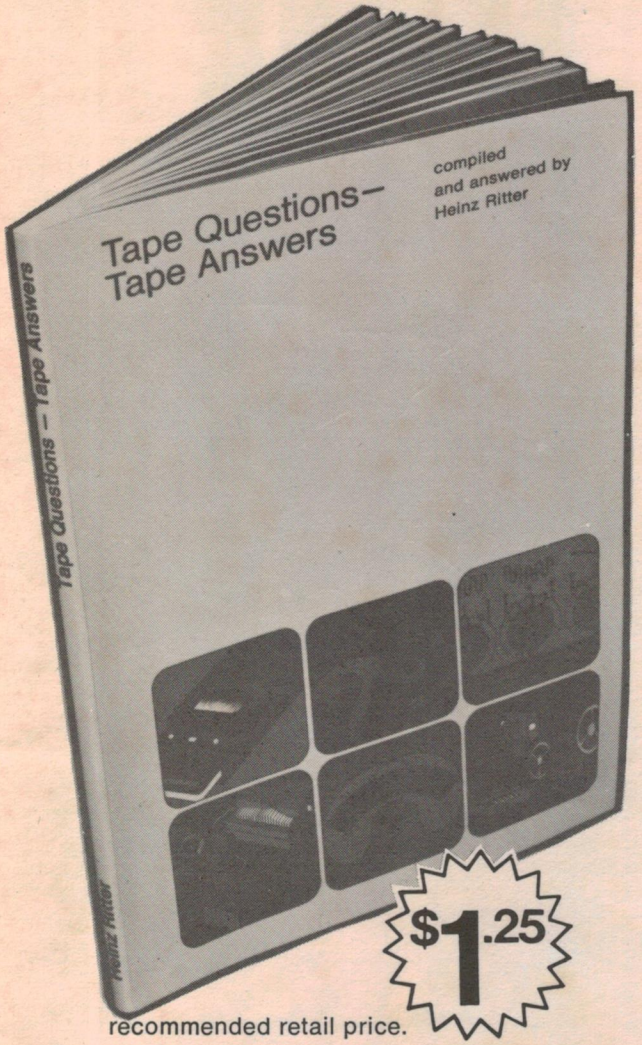

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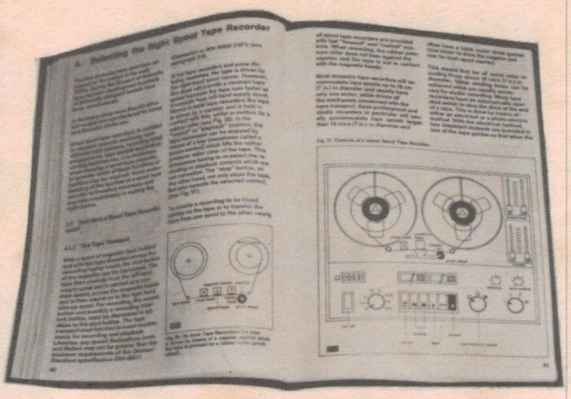

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